NASA

National Aeronautics and
Space Administration

Budget Estimates

FISCAL YEAR **1982**

Volume II

Construction of **Facilities**

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

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VOLUME II

SUMMARY
INFORMATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

GENERAL STATEMENT

The Construction of Facilities (CoF) appropriation provides for contractual services for repair, rehabilitation and modification of existing facilities; the construction of new facilities; the acquisition of related facility equipment; the design of facilities projects and advance planning related to future facilities needs.

The funds requested for 1982 provide for: the continuation of prior years' endeavors in meeting the facilities requirements for the Space Shuttle; modification of aeronautical research and development facilities; repair, rehabilitation, and modification of other facilities to maintain, upgrade and improve the usefulness of the NASA physical plant; minor construction of new facilities; and facility planning and design activities.

The projects and amounts in the budget estimate reflect Space Shuttle requirements that are time sensitive to meet specific milestones. Other program requirements for 1982 include the modification of the 12-Foot Pressure Wind Tunnel at the Ames Research Center, modifications to the Space Flight Operations Facility at the John F. Kennedy Space Center, modification of the Transonic Dynamics Tunnel at the Langley Research Center, modifications for small engine component testing at the Lewis Research Center, and modification and relocation of the 26-meter antenna at Goldstone, California.

The FY 1982 program continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and to ensure safe economical and efficient use of the NASA physical plant. This request continues the necessary rehabilitation and modification program as in prior years and continues a repair program. The purpose of the repair program is to restore facilities to a condition substantially equivalent to their originally designed capability. The minor construction program continues to provide a means to accomplish smaller facility projects which accommodate changes in technical and institutional requirements. This program also includes projects which continue NASA efforts to reduce the consumption of energy.

Funds requested for facility planning and design cover advance planning and design requirements for potential future projects, master planning, facilities studies, engineering reports and studies and the preparation of facility project design drawings and bid specifications.

The request for FY 1982 is $136,800,000, an increase of $21,800,000 above the appropriation for FY 1981. Outlays are estimated to be $156,700,000 in FY 1982, an increase of *$300,000* over the estimate for FY 1981.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATIOM

PROPOSED APPROPRIATION LANGUAGE

CONSTRUCTION OF FACILITIES

For construction, repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing facilities, and for facility planning and design not otherwise provided, for the National Aeronautics and Space Administration, and for the acquisition or condemnation of real property, as authorized by law, [$115,000,000] *$136,800,000*, to remain available until September *30,* [1983] *1984*: ***Provided,*** That, notwithstanding the limitation on the availability of funds appropriated under this head by this appropriation Act, when any activity has been initiated by the incurrence of obligations therefor, the amount available for such activity shall remain available until expended, except that this provision shall not apply to the amounts appropriated pursuant to the authorization for repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing facilities, and facility planning and design. (*42 U.S.C. 2/51, et seq.; Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1981; additional authorizing legislation to be proposed.*)

CONSTRUCTION OF FACILITIES

Program and Financing (in thousands of dollars)

Identification code 80-0107-0-1-999	Budget plan (amounts for construction of facilities actions programed)			Costs and obligations		
	1980 actual	1981 est	1982 est	1980 actual	1981 est	1982 est
Program by activities:						
Direct program:						
1. Space transportation systems	27,750	10,100	20,050	38,330	27,500	28,800
2. Scientific investigations in space	7,250	1,617	.....	3,094	3,300	2,800
3. Space and terrestrial applications	.....	.....	.....	872	.....	.....
4. Space research and technology	.....	.....	1,400	14	.....	300
5. Aeronautical research and technology	62,500	43,291	42,310	58,112	63,600	60,500
7. Supporting activity	61,600	59,992	73,040	42,556	56,200	72,900
Total direct program	159,100	115,000	136,800.	142,978	150,600	165,300
Reimbursable program:						
1. Space transportation systems	6,300	5,000	1,000	770	3,800	4,200
5. Aeronautical research and technology	1,266	5,550	4,600	733	2,200	4,100
7. Supporting activity	1,934	450	2,400	3,295	1,100	1,600
Total reimbursable program	9,500	11,000	8,000	4,798	7,100	9,900
Total program costs, funded	168,600	126,000	144,800	147,776	157,700	175,200
Change in selected resources (undelivered orders)	.....	.....	.....	993	7,700	—19,400
10.00 Total	168,600	126,000	144,800	148,769	165,400	155,800
Financing:						
11.00 Offsetting collections from Federal funds	—9,500	—11,000	—8,000	—9,500	—11,000	—8,000
Unobligated balance available, start of year: For completion of prior year budget plans:						
21.40 Direct	.....	.....	.....	—95,501	—110,466	—72,866
21.40 Reimbursable	.....	.....	.....	—2,676	—7,493	—5,693
Unobligated balance available, end of year: For completion of prior year budget plans:						
24.40 Direct	.....	.....	.....	110,466	72,866	63,366
24.40 Reimbursable	.....	.....	.....	7,493	5,693	4,193
25.00 Unobligated balance lapsing	.....	.....	.....	49	.....	.....
39.00 Budget authority	159,100	115,000	136,800	159,100	115,000	136,800
Budget authority:						
40.00 Appropriation	156,100	115,000	136,800	156,100	115,000	136.800
42.00 Transferred from other accounts	3,000	.....	.....	3,000	.....	.....
43.00 **Appropriation** (adjusted)	159,100	115,000	136,800	159,100	115,000	136,800
Relation of obligations to outlays:						
71.00 Obligations incurred, net	.....	.....	.....	139,269	154.400	147,800
72.40 Obligated balance, start of year	.....	.....	.....	139,535	138,469	136,469
74.40 Obligated balance, end of year	.....	.....	.....	—138,469	—136,469	—127,569
77.00 Adjustments in expired accounts	.....	.....	.....	—30	.....	.....
90.00 Outlays	.....	.....	.....	140,305	156,400	156,700

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1982 ESTIMATES
SUMMARY OF THE BUDGET PLAN BY LOCATION

Location	FY 1980	FY 1981	FY 1982
		(In Dollars)	
Ames Research Center	2,900,000	13,180,000	18,500,000
Goddard Space Flight Center	---	---	2,500,000
Jet Propulsion Laboratory	---	3,500,000	9,300,000
Lyndon B. Johnson Space Center	1,760,000	---	680,000
John F. Kennedy Space Center	5,810,000	760,000	2,560,000
Langley Research Center	7,980,000	20,756,000	12,710,000
Lewis Research Center	5,720,000	10,355,000	12,200,000
George C. Marshall Space Flight Center	3,540,000	---	1,400,000
Michoud Assembly Facility	3,100,000	4,582,000	---
Wallops Flight Center	1,100,000	---	---
Various Locations	---	2,150,000	6,900,000
Large Aeronautical Facilities	45,900,000	---	---
Space Shuttle Facilities	27,750,000	10,100,000	20,050,000
Space Shuttle Payload Facilities	4,250,000	1,617,000	---
Repair	12,000,000	15,000,000	15,000,000
Rehabilitation and Modification	19,790,000	19,000,000	20,000,000
Minor Construction	3,500,000	4,000,000	*4,000,000*
Facility Planning and Design	14,000,000	10,000,000	11,000,000
Total Plan	159,100,000	115,000,000	136,800,000

SUMMARY OF BUDGET PLAN BY COGNIZANT OFFICE

	FY 1980	FY 1981 (In Dollars)	FY 1982
Office of Space Transportation Systems	33.360. 000	11.717. 000	21.450. 000
Office of Space Science	1.640. 000	---	---
Office of Aeronautics and Space Technology	62.500. 000	43.291. 000	42.310. 000
Office of Space Tracking and Data Systems	---	2.150. 000	6.900. 000
Office of the Comptroller	61.600. 000	57.842. 000	66.140. 000
Total Plan	159.100. 000	115.000. 000	136.800. 000

SUMMARY OF BUDGET PLAN BY SUBFUNCTION

Code No.	Title			
253	Space Flight	27.750. 000	10.100. 000	20.050. 000
254	Space Science. Applications and Technology	7.250. 000	1.617. 000	1.400. 000
255	Supporting Space Activities	61.600. 000	59.992. 000	73.040. 000
(250)	Subtotal. General Science. Space and Technology	96.600. 000	71.709. 000	94.490. 000
402	Air Transportation	62.500. 000	43.291.000	42.310.000
	Total	159.100. 000	115.000. 000	136.800.000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

BUDGET PLAN BY LOCATION AND PROJECT

Cognizant Office	Budget Activity	Subfunction Code	Installation and Project	FY 1980	FY 1981	FY 1982	Page No.
				(Thousands of Dollars)			
			Ames Research Center	2,900	13,180	18,500	
AST	5	402	Modification of 12-Foot Pressure Wind Tunnel.....	---	---	18,500	CF 1-1
AST	5	402	Construction of Man-Vehicle Systems Research Facility..	---	7,480	---	
AST	5	402	Modification of Steam Ejector System and Thermal Protection Laboratory (N-234).....	---	2,300	---	
AST	5	402	Modification of the Unitary Plan Wind Tunnel (N-227)...	---	3,400	---	
AST	5	402	Modification of Static Test Facility (N-249).....	2,900	---	---	
			Goddard Space Flight Center	---	---	2,500	
COMP	7	255	Rehabilitation and Modification of Utility Systems.....	---	---	2,500	CF 2-1
			Jet Propulsion Laboratory	---	3,500	9,300	
COMP	7	255	Modifications to Space Flight Operations Facility (230)	---	---	9,300	CF 3-1
COMP	7	255	Modifications to Various Buildings for Energy Conservation.....	---	1,500	---	
COMP	7	255	Modifications to Various Buildings for Seismic Protection.....	---	2,000	---	
			Lyndon B. Johnson Space Center	1,760	---	680	
COMP	7	255	Rehabilitation of Utility Control System, Various Buildings.	---	---	680	CF 4-1

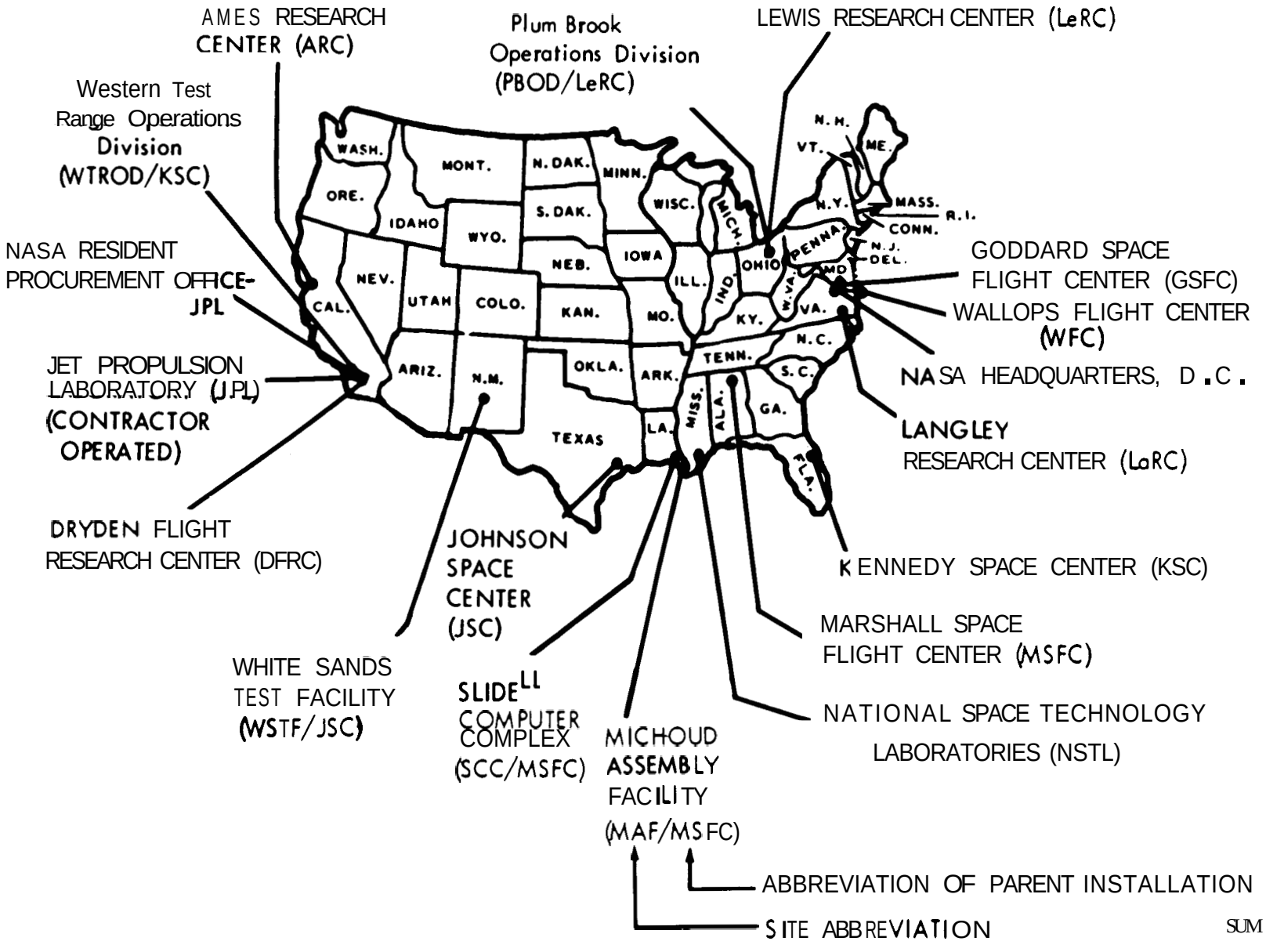
Cognizant office	Budget Activity	Subfunction Code	Installation and Project	FY 1980	FY 1981	FY 1982	Page No.
				(Thousands of Dollars)			
COMP	7	255	Rehabilitation and Modification of Flight Operations Facilities, Ellington AFB	1,760	---	---	
			John F. Kennedy Space Center	5,810	760	2,560	
COMP	7	255	Construction of Waste Material Incinerator	---	---	895	CF 5-1
COMP	7	255	Rehabilitation and Modification of Various Buildings	---	---	840	CF 5-8
COMP	7	255	Repair of Operations and Checkout Building Roof	---	---	825	CF 5-17
COMP	7	255	Rehabilitation of High Temperature Hot Water System, Zone 2, Industrial Area	---	760	---	
COMP	7	255	Modifications to the Central Instrumentation Facility	1,260	---	---	
STS	2	254	Modifications to Launch Complex 17B	3,000	---	---	
COMP	7	255	Modifications to the Operations and Checkout Building	950	---	---	
COMP	7	255	Rehabilitation of Roof, Launch Control Complex	600	---	---	
			Langley Research Center	7,980	20,756	12,710	
AST	5	402	Modifications for Enhanced 20-Inch Supersonic Wind Tunnel (1247D)	---	---	2,950	CF 6-1
AST	5	402	Modificatiods to Mach 19 Nitrogen Tunnel (1247B)	---	---	1,760	CF 6-9
AST	5	402	Modification of Transonic Dynamics Tunnel (648)	970	---	8,000	CF 6-17
AST	5	402	Modifications for Avionics Integration Research Laboratory (1220)	---	5,756	---	
AST	5	402	Modifications to Aircraft Landing Dynamics Facility (1257)	---	15,000	---	
AST	5	402	Rehabilitation and Modification of Gas Dynamics Laboratory (1247)	3,600	---	---	
AST	5	402	Modifications of Model Support System 8-Foot High Temperature Structures Tunnel (1265)	1,410	---	---	
AST	5	402	Modifications to 8-Foot Transonic Pressure Tunnel (640)	2,000	---	---	

Cognizant Office	Budget Activity	Subfuncti Code	Installation and Project	FY 1980	FY 1981	FY 1982	Page No.
				(Thousands of Dollars)			
			Lewis Research Center	5,720	10,355	12,200	
corn	7	255	Decommissioning of Plum Brook Station Reactor Facility, Phase II	---	1,000	1,100	CF 7-1
AST	5	402	Modifications for High Pressure Turbine Corrosion and Thermal Fatigue Testing	---	---	1,200	CF 7-10
AST	5	402	Modifications for Small Engine Component Testing (5 and 23)	---	---	9,900	CF 7-18
AST	7	402	Modifications to Central Air System, Various Buildings.	5,720	7,655	---	
AST	7	402	Rehabilitation of Electrical Switchgear, Engine Research Building (5)	---	1,700	---	
			George C. Marshall Space Flight Center	3,540	---	1,400	
STS	4	254	Modifications for Solar Electric Propulsion Systems Thruster Testing	---	---	1,400	CF 8-1
corn	7	255	Modifications to Various Buildings	2,640	---	---	
COMP	7	255	Rehabilitation of Roofs, Various Buildings	900	---	---	
			Michoud Assembly Facility	3,100	4,582	---	
COMP	7	255	Rehabilitation of Roof, Phase II, Building 103	---	3,800	---	
COMP	7	255	Rehabilitation of Chilled Water System	---	782	---	
COMP	7	255	Rehabilitation of Roof, Phase I, Building 103	3,100	---	---	
			Wallops Flight Center	1,100	---	---	
COMP	7	255	Construction of Facilities Operations Shop Building	1,100	---	---	
			Various Locations	---	2,150	6,900	
ST&DS	7	255	Modification and Relocation of 26-Meter Antenna, STDN, Goldstone, Calif. (JPL)	---	---	4,700	CF 9-1
STCDS	7	255	Relocation of the DSS-44 Antenna to Tidbinbilla, Australia (JPL)	---	---	2,200	CF 9-8

Cognizant Office	Budget Activity	Subfunction Code	Installation and Project	FY 1980	FY 1981	FY 1982	Page No.
				(Thousands of Dollars)			
ST&DS	7	255	Modification of 26-Meter Antenna, DSS-44, Canberra, Australia (JPL)	---	1,200	---	
ST&DS	7	255	Replacement of Azimuth Radial Bearing, DSS-14, Goldstone, Calif. (JPL)	---	950	---	
			Large Aeronautical Facilities at Various Locations as Follows:	45,900	---	---	
AST	5	402	Construction of National Transonic Facility (LaRC)	12,000	---	---	
AST	5	402	Modification of 40x80-Foot Subsonic Wind Tunnel (ARC)	33,900	---	---	
			Space Shuttle Facilities at Various Locations as Follows:	27,750	10,100	20,050	
STS	1	253	Construction of Solid Rocket Booster Processing and Segment Storage Facilities (KSC)	---	---	12,400	CF 10-4
STS	1	253	Modifications to Firing Rooms (KSC)	---	---	3,100	CF 10-12
STS	1	253	Modification of Manufacturing and Final Assembly Facilities for External Tanks (MAF)	6,900	5,400	2,785	CF 10-19
STS	1	253	Modifications to Building 30 for Shuttle Operations (JSC)	---	---	650	CF 10-26
STS	1	253	Minor Shuttle-Unique Projects (Various Locations)	2,500	2,000	1,115	CF 10-34
STS	1	253	Modifications to Solid Rocket Motor Manufacturing and Assembly Facilities, Thiokol Plant, Wasatch, Utah	---	2,700	---	
STS	1	253	Modifications to Crawler Transporter Maintenance Facility (KSC)	1,250	---	---	
STS	1	253	Modification to Launch Complex 39 (KSC)	17,100	---	---	
			Space Shuttle Payload Facilities at Various Locations as Follows:	4,250	1,617	---	
STS	2	254	Rehabilitation and Modification for Payload Ground Support Operations (KSC)	2,610	1,617	---	

Cognizant Office	Budget Activity	Subfunction Code	Installation and Project	FY 1980	FY 1981	FY 1982	Page No.
				(Thousands of Dollars)			
SS	2	254	Modification of an Addition to Materials Sciences Laboratory (N-240) (ARC)	1,640	---	---	
COMP	7	255	Repair of Facilities at Various Locations, Not in Excess of $500,000 per Project	12,000	15,000	15,000	CF 11-1
COO	7	255	Rehabilitation and Modification of Facilities at Various Locations, Not in Excess of $500,000 per Project	19,790	19	20,000	CF 12-1
COO	7	255	Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not in Excess of $250,000 per Project	3,500	4,000	4,000	CF 13-1
COMP	7	255	Facility Planning and Design	14,000	10,000	11,000	CF 14-1
			TOTAL	159,100	115,000	136,800	

LOCATION OF NASA MAJOR AND COMPONENT INSTALLATIONS



RECORDED VALUE OF CAPITALIZED TYPE PROPERTY
IN-HOUSE AND CONTRACTOR-HELD
AS OF SEPTEMBER 30, 1980
(DOLLARS IN THOUSANDS)

Reporting Installation	Real Property Land	Buildings	Other Structures and Facilities	Leasehold Improvements	Total	Equipment	Fixed Assets in Progress	Grand Total
Ames Research Center	$ 2,928	$ 214,687	$ 10,346	$ -0-	$ 227,961	$ 198,403	$ 91,918	$ 518,282
ARC - Moffett Field, CA	2,928	214,687	10,346	-0-	227,961	185,758	91,918	505,637
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	12,645	-0-	12,645
Dryden Flight Research Center	-0-	15,387	6,961	-0-	22,348	57,914	3,040	83,302
DFRC - Edwards AFB,CA	-0-	15,387	6,961	-0-	22,348	56,924	3,040	82,312
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	990	-0-	990
Goddard Space Flight Center	1,685	105,220	59,039	-0-	165,944	528,745	29,529	724,218
GSFC - Greenbelt, MD	1,353	89,858	18,033	-0-	109,244	212,454	24,037	345,735
Tracking Stations (Networks)	332	15,361	40,961	-0-	56,654	232,289	5,492	294,435
Various Locations	-0-	1	45	-0-	46	84,002	-0-	84,048
Jet Propulsion Laboratory	1,188	90,916	67,706	1,455	161,265	246,751	21,933	429,949
JPL-Pasadena, CA	1,188	79,425	11,947	1,455	94,015	170,777	21,933	286,725
Deep Space Network	-0-	11,491	55,759	-0-	67,250	75,974	-0-	143,224
Johnson Space Center	9,107	199,120	62,444	-0-	270,671	608,577	25,731	904,979
JSC - Houston, TX	5,537	162,712	35,793	-0-	204,042	375,098	21,293	600,433
White Sands Test Facility								
WSTS - Las Cruces, NM	-0-	9,631	21,094	-0-	30,725	17,469	-0-	48,194
Various Locations (a)	3,570	26,777	5.557	-0-	35,904	216,010	4,438	256,352
Kennedy Space Center	71,345	373,472	382,762	-0-	827,579	934,382	72,612	1,834,573
KSC - Cape Canaveral, FL	71,345	373,472	382,762	-0-	827,579	928,929	72,612	1,829,120
Western Test Range Operations								
Div. WTROD-Lompoc, CA	-0-	-0-	-0-	-0-	-0-	4,057	-0-	4,057
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	1,396	-0-	1,396
Langley Research Center	162	135,586	258,797	-0-	394,545	184,587	29,481	608,613
LARC - Hampton, VA	162	135,586	258,746	-0-	394,494	167,297	29,481	591,272
Various Locations (a)	-0-	-0-	51	-0-	51	17,290	-0-	17,341
Lewis Research Center	2,230	215,619	76,489	136	294,474	153,298	15,487	463,259
LERC - Cleveland, OH	316	139,269	58,075	136	197,796	115,094	15,487	328.377
Plumbrook Operations Division								
PBOD - Sandusky, OH	1,914	76,350	18,414	-0-	96,678	6,645	-0-	103,323
Various Locations	-0-	-0-	-0-	-0-		31,559	-0-	31,559
Marshall Space Flight Center	7,160	213,544	134,279	-0-	354,983	421,361	2,195	778,539
MSFC - Huntsville, AL	-0-	123,632	65,632	-0-	189,264	262,391	2,195	453,850
Michoud Assembly Facility								
MAF - New Orleans, LA	7,095	80,729	55,928	-0-	143,752	18,902	-0-	162,654
Slidell Computer Complex								
SCC - Slidell, LA	65	5,042	2,041	-0-	7.148	8,649	-0-	15,797
Various Locations (a)	-0-	4,141	10,678	-0-	14,819	131,419	-0-	146,238
National Space Technology Labs.	14,061	69,893	194,664	-0-	282,618	24,134	-0-	306,752
NSTL - NSTL statim, MS	18,061	69,893	194,664	-0-	282,618	24,101	-0-	306,719
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	33	-0-	33
Wallops Flight Center	1,391	27,180	53,808	-0-	82,379	57,025	5,958	145,362
WFC - Wallops Island, VA	1,391	27,180	53,808	-0-	82,379	54,712	5,958	143,049
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	2,313	-0-	2,313
NASA Headquarters	-0-	-0-	-0-	-0-	-0-	16,710	6,644	23,354
Washington, D. C.	-0-	-0-	-0-	-0-	-0-	8,176	6,644	14,820
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	8.534	-0-	8,534
TOTAL	$ 115,257	$ 1,660,624	$ 1,307,295	$ 1,591	$ 3,084,767	$ 3,431,887	$ 304,528	$ 6,821,182

(a) Includes Property in Possession of Contractors at Various Locations.

JUSTIFICATION
BY LOCATION

AMES RESEARCH
CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

AMES RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Modification of 12-Foot Pressure Wind Tunnel.....	18,500,000	CF 1-1

AMES RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATION OF 12-FOOT PRESSURE WIND TUNNEL

LOCATION PLAN

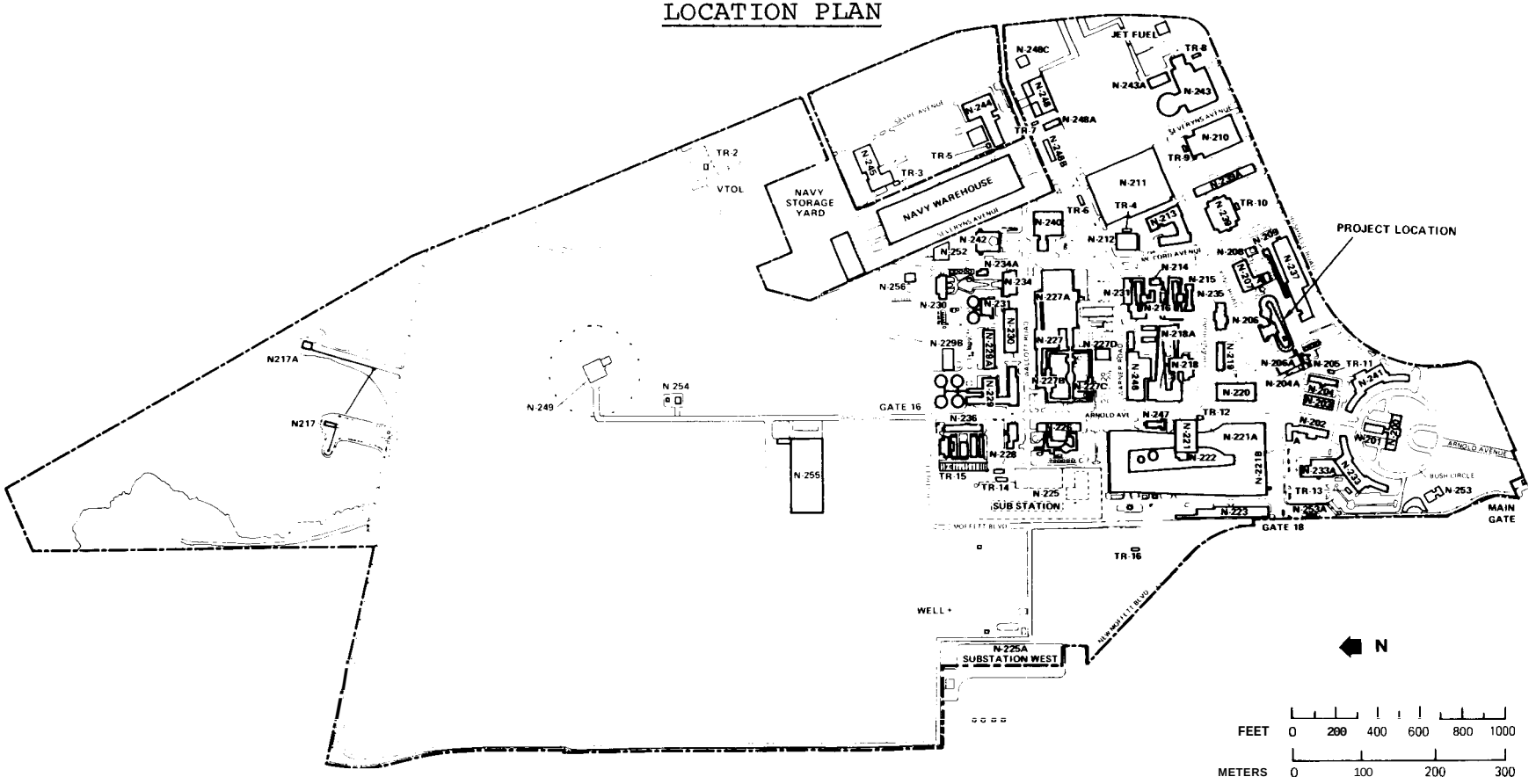


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Modification of 12-Foot Pressure Wind Tunnel

INSTALLATION: Ames Research Center

FY 1982 CoF ESTIMATE: $18,500,000

LOCATION OF PROJECT: Moffett Field, Santa Clara County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding..	1,100,000	2,482,000	3,582,000
Capitalized investment	N/A	5,940,088	5,940,088
Total	1,100,000	8,422,088	9,522,088

SUMMARY PURPOSE AND SCOPE:

This project provides for Modifications to the 12-Foot Pressure Wind Tunnel at Ames Research Center (ARC), primarily to increase the tunnel's research productivity. This heavily used subsonic, variable density, high Reynolds number facility has been in operation since 1946. Although it has been operating on a two-shift basis, a two year backlog of valid research requests for testing in the tunnel currently exists. The proposed modifications will enable twice as many wind tunnel tests to be performed in the same amount of time as is presently the case. The modifications will reconfigure the test section to allow fully assembled models to be inserted without having to depressurize and subsequently repressurize the entire tunnel circuit thereby

achieving a major reduction in model installation times. Also, separate model preparation rooms for checkout and calibration prior to insertion in the test section will be provided. Other modifications included in this project will also improve the tunnel's performance and productivity.

PROJECT JUSTIFICATION:

The 12-Foot Pressure Wind Tunnel (12-Foot PWT) is a high demand, unique aeronautics ground test facility because of its reasonably large physical size and exceptionally low turbulence, high Reynolods number capability at low subsonic speeds. Low turbulence, high Reynolds number testing is vital in the development of high performance aircraft. The value of testing in the 12-Foot PWT has long been recognized by private industry and the government. Significant amounts of test time have recently been requested for development testing of transports such as the Boeing 757 and 767 and derivatives of the Douglas DC-9 and DC-10. Energy efficient transport concepts, advanced rotorcraft, advanced fighters, and V/STOL configurations have been and will continue to be tested in this tunnel. As a result of this very high demand, the operating schedule has been continously overburdened. Tests are typically scheduled 12 to 24 months in advance despite the fact that the tunnel is operating two and sometimes three shifts per day. This has adversely impacted our ability to meet the aviation community needs for timely wind tunnel data. Important NASA research activities are often deferred for many months in order to accommodate one or more high priority development programs. The proposed modifications will reduce the tunnel occupancy time required for each test thereby significantly increasing productivity. The resultant increased capability will greatly enhance NASA's responsiveness to test requests from other federal agencies and industry and will increase tunnel time available for vital NASA research.

The productivity of the 12-Foot PWT is presently very low due to the operating limitations imposed by the design of the facility. For example, the tunnel operates at pressures as high as five atmospheres, but each model change or model adjustment requires that the entire wind tunnel circuit be returned to one atmosphere because the model and test section cannot be pneumatically isolated. It takes from 90 minutes to three hours to depressurize, open the tunnel, make model adjustments, close the tunnel, and pump up to operating pressure.

Another significant factor contributing to low productivity is the inability to assemble, check out, and calibrate models in locations other than in the test section. Presently, final assembly of models is done in the test section because the existing access hatch is too small to accommodate models larger than 11 feet (3.4 meters) by 5 feet, 4 inches (1.6 meters). Model components have to be brought in from above the test section (Figure 2) by crane, thus making the entire operation very time consuming.

To achieve a higher level of productivity, modifications of associated systems such as the makeup air system and drive compressors are also included in this project. These modifications will insure the necessary reliability during increased tunnel operations. It is estimated that on the average, the total time required

from model preparation and assembly, through conducting the tests in the wind tunnel will be reduced by 50 percent or more.

IMPACT OF DELAY:

If this project is delayed, the existing two year backlog of test requirements could become longer as more sophisticated models that require extensive wind tunnel testing are produced. The 12-Foot PWT is a unique facility that provides valuable data to the aviation industry and the government. Extensive flight testing would have to be performed at higher costs and technical risks if the tunnel improvements are not provided.

PROJECT DESCRIPTION:

The modifications (Figure 2) provided by this project can be separated into the following categories: model airlock, test section, model support systems, tunnel automation/checkout, compressor blade changes, building modifications, and rehabilitation and modification of auxiliary systems.

A model airlock (Figure 3), approximately 22 feet (6.7 meters) long by 10 feet (3 meters) wide by 9 feet (2.7 meters) high, will be constructed to isolate the model from the tunnel above the tunnel test section. This will allow the tunnel to stay pressurized to five atmospheres while adjustments to the model can be made outside the test section. This will save the time and energy now required to depressurize and repressurize the tunnel.

Three model support systems will be provided to accommodate the new airlock system:

- The turntable support system will be a single degree of freedom motion mechanical motion device. It will be constructed to be compatible with semi-span floor mounted models, bi-pod mounted models and high angle of attack models.

- The high speed model support system will be a three degree of freedom mechanized device consisting of a vertically traversing strut and a center body. The complete system will be mounted and supported on the movable test section floor. The system will accommodate rear sting mounted models.

- The thru support system will accommodate two-dimensional wing models which must span the tunnel horizontally between the test section walls.

The test section will be modified to install a movable floor that will seal the bottom of the airlock (Figure 3). The necessary work includes the installation of stiffner rings and tie girders, new fairings and a lifting

system to move the test section floor vertically. The tunnel test section will be modified to provide improved optical access as well as personnel access. This will be accomplished by the installation of optical windows and personnel access doors into the test section.

New tunnel control systems will be installed to control model attitudes and Mach number. Mach number control will be via an executive controller which will issue proper commands to the tunnel drive, rotor blade pitch and stator vane controls. An automated model checkout system that will be used for calibrating and preparing the models prior to testing in the wind tunnel, will be installed in the model checkout rooms and linked to the data acquisition system.

The tunnel compressor consists of two fans of 12 and 20 blades. The blade pitch angle can presently be adjusted manually. This project will provide the capability for remote pitch adjustments of these blades under full compressor drive power and aerodynamic load. The positioning mechanism will be modified to provide mechanical synchronization of all the blades on each fan. The existing aluminum blades have been a maintenance problem, requiring frequent inspections. New blades that have a longer fatigue life will be purchased for the compressor.

Several building modifications must be made to efficiently handle test models. A new fourth floor, at the same elevation as the top of the model airlock frame will be constructed. A four-story addition will be constructed to vertically house four model buildup rooms and adjoining offices each at a different level. The building addition will include a large freight elevator to allow transporting equipment from the model buildup rooms to either the fourth floor model installation area or the ground floor entry level. Each of the rooms will contain a 1.5-ton capacity bridge crane, heating, ventilating, and air-conditioning, electrical power, and a storage area.

To insure continued and reliable operation of the wind tunnel, various components will be replaced or repaired. The high pressure air system will be modified to increase the pumping and storage capabilities. This will also provide the desireable system redundancy needed to maintain high productivity. The existing makeup air system will be modified to insure reliable operation.

'PROJECT COST ESTIMATE:

This cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition	---	---	---	---
Construction.	---	---	---	18,500,000
Model airlock	LS	---	---	2,300,000
Model support systems	LS	---	---	2,250,000
Test section	LS	---	---	4,000,000
Tunnel automation/checkout	LS	---	---	2,600,000
Compressor modifications	LS	---	---	1,400,000
Building modifications an3 additions	LS	---	---	2,150,000
Rehabilitation and modification of auxiliary systems	LS	---	---	3,800,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				18,500,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Wind Tunel Circuit
Figure 3 - Test Section

OTHER EQUIPMENT SUMMARY:

No other equipment is needed for this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future funding is required to complete this project.

AMES RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATION OF 12-FOOT PRESSURE WIND TUNNEL

WIND TUNNEL CIRCUIT

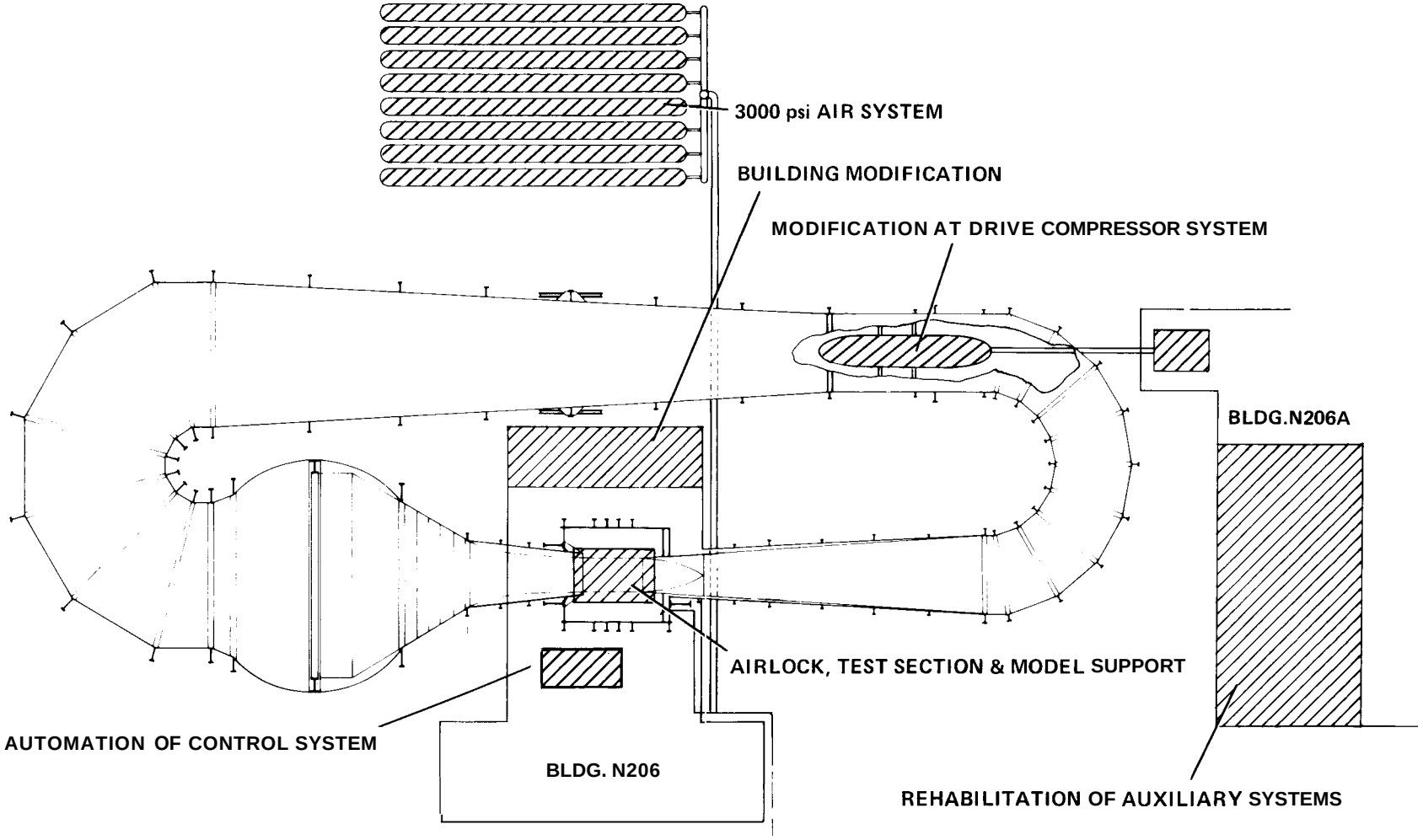
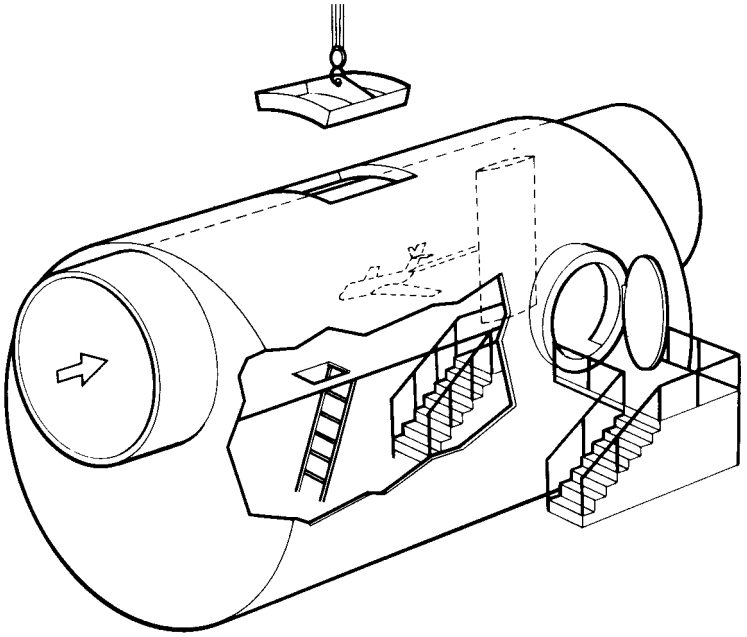


FIGURE 2

AMES RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATION OF 12-FOOT PRESSURE WIND TUNNEL

TEST SECTION

EXISTING TEST SECTION



PROPOSED TEST SECTION

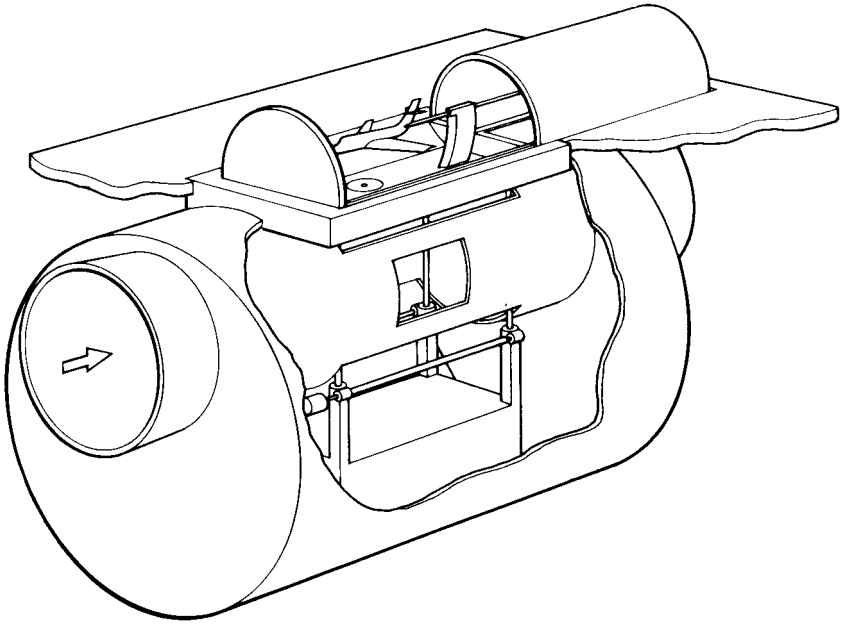


FIGURE 3

GODDARD
SPACE FLIGHT
CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

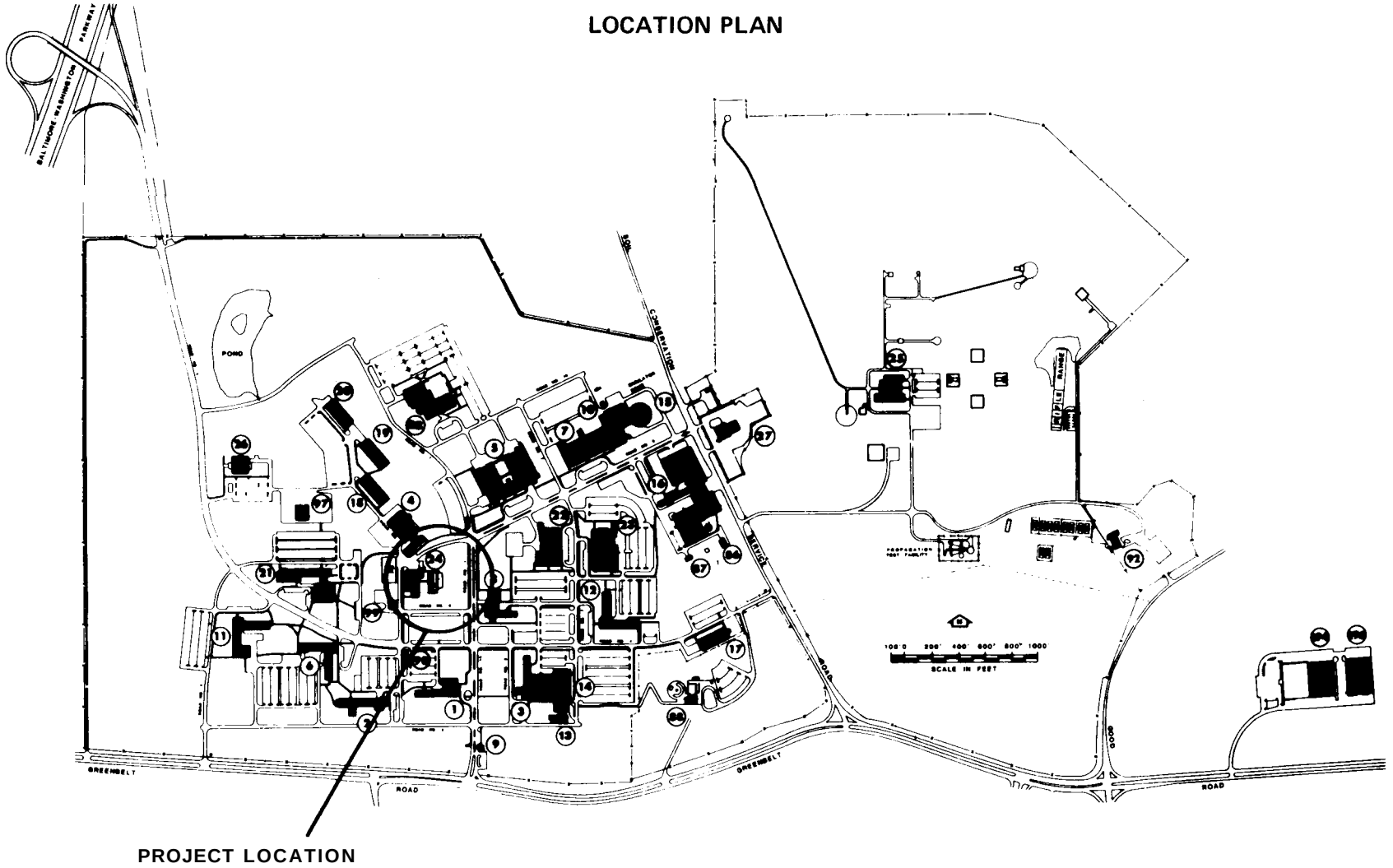
SUMMARY

GODDARD SPACE FLIGHT CENTER

	Amount	Page No.
Office of the Comptroller:		
Rehabilitation and Modification of Utility Systems.....	2,500,000	<F 2-1

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1982 ESTIMATES
REHABILITATION AND MODIFICATION OF UTILITY SYSTEMS

LOCATION PLAN



PROJECT LOCATION

FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification of Utility Systems

INSTALLATION: Goddard Space Flight Center

FY 1982 CoF ESTIMATE: $2,500,000

LOCATION OF PROJECT: Greenbelt, Prince Georges County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	210,000	---	210,000
Capitalized investment	N/A	5,350,000	5,350,000
Total	210,000	5,350,000	5,560,000

SUMMARY PURPOSE AND SCOPE:

These resources will provide for the rehabilitation and modification of utility systems at the Goddard Space Fight Center (GSFC). The chilled water system in the Central Heating and Refrigeration Plant, Building 24, will be rehabilitated through replacement of two chillers and cooling tower "A". This equipment is approximately 15 years old, unreliable, inefficient, and under capacity. Replacement of these chilled water systems is urgently needed at this time to insure reliable environmental control for critical real-time spacecraft and data processing operations.

PROJECT JUSTIFICATION:

GSFC is responsible for program development and management of unmanned earth orbit satellites, the Delta program, and the management and operation of NASA's tracking and communications network. Reliable utility systems are essential to the operation of technical facilities used for these functions and other vital center operations. The rehabilitation and modification of the chilled and condenser water utility system is necessary at this time to return the systems to full service and provide reliable operational support.

The Center's chilled water distribution system and the attendant condenser water system were installed in the early 1960's and have since been expanded to meet the cooling requirements for additional facilities. Portions of the chilled water equipment and a cooling tower at the Central Heating and Refrigeration Plant, Building 24, have deteriorated to the point that they are now inadequate to support the Center's cooling requirements during peak demand periods. Engineering studies have established that GSFC has a present cooling load of 8,500 tons (29,866 kilowatts) and this load is anticipated to grow to over 9,000 tons (31,623 kilowatts) during the next five years. The four original steam driven chillers and cooling tower "A" have reached the end of their economical service life and are now unreliable and inefficient. Two of the four existing electric chillers are now over 15 years old, energy inefficient, difficult to maintain, and need to be replaced. The two remaining electric chillers and cooling tower "B" are less than 15 years old and are in good operating condition. A comprehensive plan has been developed to rehabilitate and modify the chilled water system to meet future needs while continuing to provide current Center cooling requirements.

The plan for the rehabilitation and modification of the central chilled water system in Building 24 includes the replacement of two steam chillers and one electric chiller with two energy efficient, state-of-the-art, electric chillers with a combined capacity of 5,000 tons (17,565 kilowatts). Cooling tower "A" will be replaced with a larger tower to support the new chillers. Completion of this project will provide a chilled water system consisting of five (5) electric drive chillers with a total capacity of 12,000 tons (42,164 kilowatts) to meet the Center's anticipated peak demand needs.

IMPACT OF DELAY:

Delay in accomplishing the rehabilitation and modification of the utility systems will result in the continuation of the present unsatisfactory chiller reliability and marginal effectiveness.

PROJECT DESCRIPTION:

This project provides for the rehabilitation and modification of the Center's chilled water system in the Central Heating and Refrigeration Plant, Building 24 (Figure 1). The work will include the removal of three

old chillers and the installation of two state-of-the-art electric driven chillers with a capacity totaling 5,000 tons (17,569 kilowatts) as shown in Figure 2. The installation includes: modification of supply and return water piping and valves with thermal insulation; the strengthening of the foundation and installation of floor supports for piping and other equipment; and electrical modification to include increased power supply and controls with attendant ducts and conduits for cables and wiring.

Cooling tower "A" will be replaced with a new four cell tower of 4,000 tons (14,055 kilowatts) capacity, also shown in Figure 2. Incident to this installation will be the rehabilitation of existing condenser water pumps and the replacement of fans. An equalizing line will be installed to connect cooling towers "A" and "B" to allow either or both towers to support both new and existing chillers.

PROJECT COST ESTIMATE:

The project cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1,700,000
Demolition	LS	---	---	50,000
Install chillers	LS	---	---	*590,000*
Piping, valves and insulation	LS	---	---	170,000
Foundation and equipment supports	LS	---	---	80,000
Electrical power and controls	LS	---	---	140,000
Rehabilitation of cooling tower "A"	LS	---	---	670,000
Equipment	---	---	---	800,000
Electric chiller 3,000 ton	LS	---	---	450,000
Electric chiller 2,000 ton	LS	---	---	*350,000*
Fallout Shelter (not feasible)	---	---	---	---
Total				2,500,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Modifications to Chilled Water System

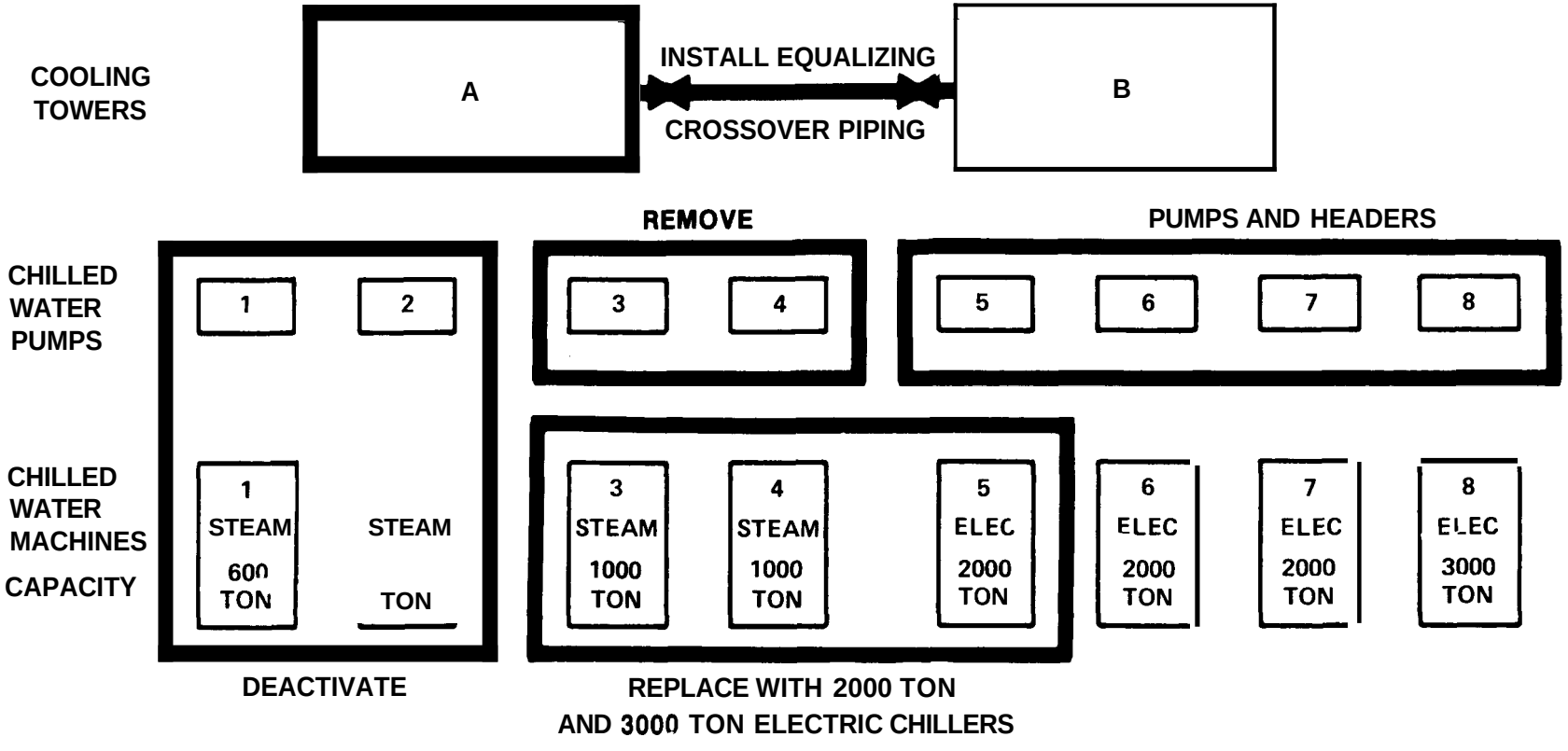
OTHER EQUIPMENT SUMMARY:

No other equipment is needed to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Future CoF funding will be required to undertake subsequent rehabilitation and modification of utility systems.

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1982 ESTIMATES
REHABILITATION AND MODIFICATION OF UTILITY SYSTEMS



MODIFICATIONS TO CHILLED WATER SYSTEM
FIGURE 2

JET **PROPULSION**
LABORATORY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

JET PROPULSION LABORATORY

	Amount	Page No.
Office of the Comptroller:		
Modifications to Space Flight Operations Facility (230).....	9,300,000	CF 3-1

JET PROPULSION LABORATORY
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO SPACE FLIGHT OPERATIONS FACILITY (230)

LOCATION PLAN

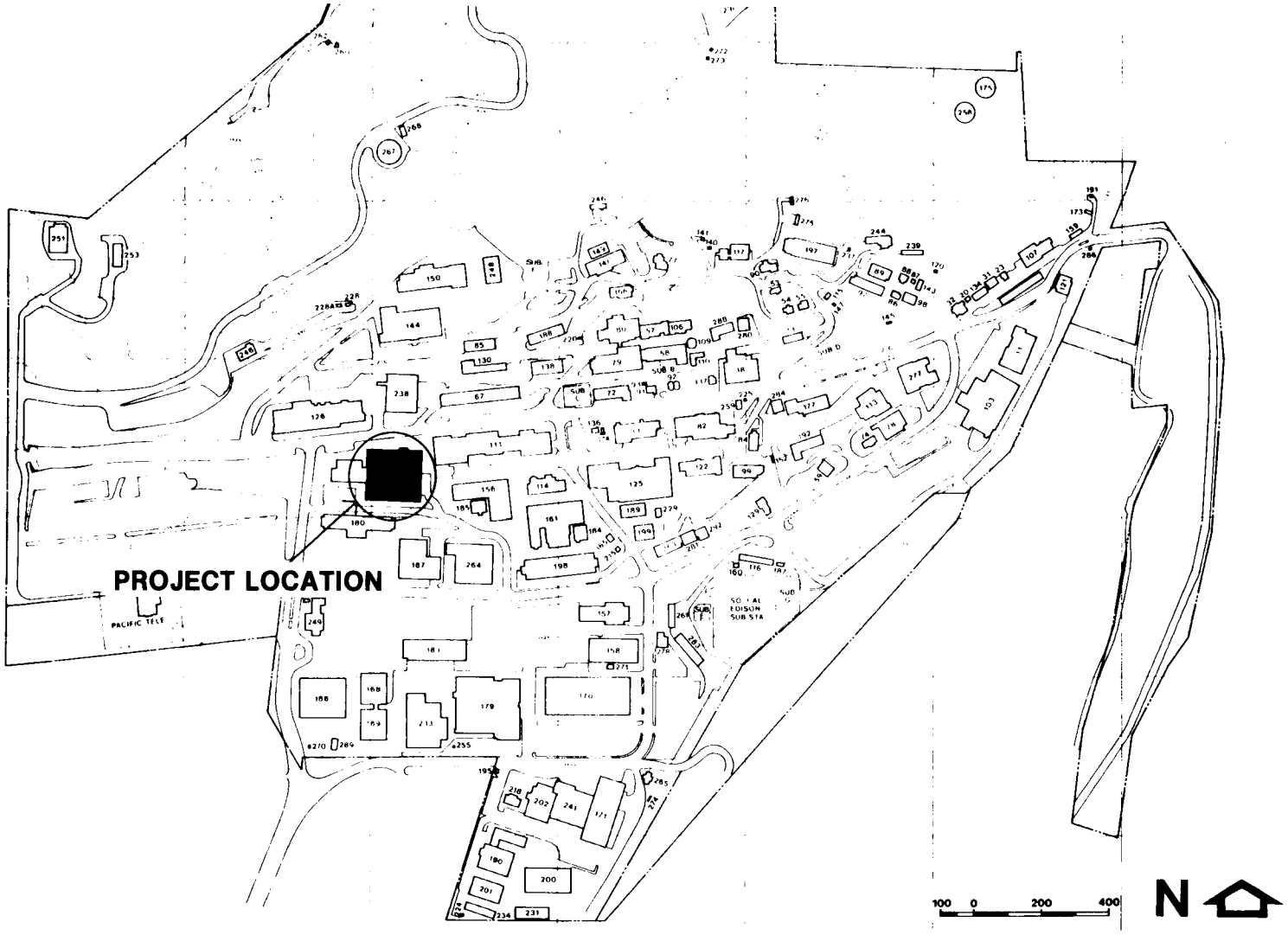


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Modifications to Space Flight Operations Facility (230)

INSTALLATION: Jet Propulsion Laboratory

FY 1982 CoF ESTIMATE: $9,300,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	875,000	---	575,000
Capitalized investment	N/A	12,150,000	12,150,000
Total	875,000	12,990,000	13,025,000

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to the Space Flight Operations Facility (SFOF), Building 230, at JPL. The SFOF contains high value computers, communication and operational equipment utilized in the support of all mission control activities at JPL. This facility also is the terminal for the NASA Deep Space Tracking network and worldwide communications system. The building was constructed in 1963 to support the Ranger series of spacecraft and has been expanded over the intervening years, without interruption to ongoing programs, to support subsequent planetary exploration exploration programs. Due to the severe limitations placed on expansion and major rehabilitation because of interference with ongoing programs, the SFOF now requires extensive

modifications to support future programs. The project is also required to correct significant hazards to personnel and high value property. Modifications to the second and third floors of the SFOF will include critically essential fire protection for the building, personnel and equipment. These modifications also will significantly improve essential building systems reliability and make the facility capable of meeting changing mission support requirements. Modifications to this vital spacecraft mission control facility are needed now to continue necessary support for the planetary exploration programs.

PROJECT JUSTIFICATION:

JPL is responsible for conducting NASA programs for scientific exploration of the planets and interplanetary space using automated spacecraft. This responsibility also includes the operation of NASA's worldwide Deep Space Tracking Network and a Mission Control and Computing Center. The SFOF, Building 230, is the operational "nerve center" for these mission flight control activities at JPL. The SFOF houses the Mission Control activities where computers (over sixty), communications systems, video displays, and instrumentation, valued in excess of $30 million, must operate continuously in a controlled environment.

The SFOF was constructed in 1963 as a combination communications, electronic monitoring, computer, and office building. Since then the SFOF has changed significantly. Space flight techniques and equipment for controlling the missions have become markedly more sophisticated. From 1963 to 1969, four additions to the initial SFOF were constructed to meet increasing capacity and technology requirements.

The operating areas in the SFOF have been provided to meet specific flight mission requirements. This dmphasis on individual spacecraft requirements has resulted in marginal fire protection and has created safety conditions which now violate current codes and regulations. During the last 20 years much has been learned nationally about the risks associated with large scale computer installations and has resulted in more stringent standards for the protection of personnel and essential electronic equipment operations from fire hazards. In the case of SFOF, time periods to make the required major physical modifications has been extremely limited due to ongoing missions.

The hazardous conditions include nonexistent and/or nonconforming exits for personnel, inadequate corridors and fire detection systems, no internal fire suppression for essential electronic equipment, no fire separations between major occupancy areas, no smoke purge capability for the HVAC system (necessary in windowless buildings), and open penetrations of structural floor slabs. The proposed modifications will correct these hazardous conditions as well as establish efficient facility configurations which will preclude such problems in the future.

As the SFOF was expanded, heating, ventilating and air-conditioning (HVAC) equipment was provided for each addition. As the facility was tailored to meet changing spacecraft requirements, little could be done to consolidate and integrate the equipment because of space and schedule limitations. As a result, the facility operates with a multitude of interconnected, noncompatible, small HVAC systems. These systems have been repaired many times since the first system was installed 17 years ago and much of the equipment is near the end its useful service life. The HVAC distribution system also does not provide any reasonable redundancy or reliability for the mission support activities in this facility. The inefficient arrangement of old and inadequate HVAC equipment has caused excessive maintenance costs and utility bills of over $1.0 million per year.

Several detailed studies of the SFOF problem have been conducted and these proposed modifications have been determined to be the most cost effective with minimum impact on operational missions. A detailed plan has been developed for making the necessary modifications while continuing to support ongoing spacecraft missions. The initial phase was included in the FY 1979 Construction of Facilities Program and provided an addition to the building and the installation of new air-conditioning water chillers and a hot water system. This second increment of work modifies the second and third floors of the SFOF. The basement and first floor modification work is similar but less extensive and will be considered for a future CoF program. The total required modifications to the HVAC system will result in a more efficient operation with an estimated energy savings of over $250,000 a year, and will reduce the center's energy consumption by approximately four percent from FY 1980.

The urgency for implementing this project during Fiscal Year 1982 is directly related to mission support activities in the SFOF. These will be at a minimum after the Voyager II's Saturn encounter in August 1981. This unique period of minimum mission activities will permit removal of computer equipment from up to one-half of each floor. The partitions will be demolished and old air distribution and related systems will be removed. The work can then be accomplished with minimum impact on continuing deep space operations such as the Voyager II cruise mode to Uranus and the Infrared Astronomy Satellite. All of the modification work is planned to be completed by late 1983 before the Galileo missions in early 1984. These modifications to the SFOF need to be accomplished now for this vital facility to continue to adequately support the planetary exploration programs.

IMPACT OF DELAY:

Delay in accomplishing these modifications to the SFOF will result in a marginal facility to support Galileo and future spacecraft operations with increasing risk of mission interruptions. Delay would also result in continuing an unacceptable level of risk for both personnel and equipment due to existing hazardous conditions.

PROJECT DESCRIPTION:

This project provides for the modifications to approximately 58,000 square feet (5,388 square meters) of space on the second and third floors of the SFOF (Figure 1). The partitions, ceilings, lighting fixtures, and air distribution and electrical equipment will be removed as necessary. The modification of approximately 29,000 square feet (2,694 square meters) of space on each floor will be accomplished to create four fire zones per floor (Figure 2). These fire zones will be separated by a system of corridors leading to three existing stairways. The building structural framing will be reinforced to accommodate the new air handling units on the roof. Work in each zone includes the installation of new partitions, ceilings, lighting fixtures, flooring, fire detection and underfloor suppression systems. Raised computer flooring will be installed where necessary. The air distribution system will be replaced with a new system to support planned computer and data processing activities.

The roof will be modified by the addition of a shelter for HVAC equipment and related structural work. This work will involve removing the old HVAC equipment and replacing it with 12 air handlers and controllers to accommodate economizer cycles and smoke purging. This work includes new piping, pumps, air distribution ducts, dampers, and roofing modifications. All of the required electrical power to the air handling units, pumps, panel boxes, and associated equipment is included.

PROJECT COST ESTIMATE:

The basis of this cost estimate is a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	9,300,000
Architectural				1,580,000
Second floor	SF	29,000	21.90	(635,000)
Third floor area	SF	29,000	23.79	(690,000)
Roof/shelter	SF	29,000	8.79	(255,000)
Structural				1,310,000
Second floor	SF	29,000	2.41	(70,000)
Third floor	SF	29,000	17.59	(510,000)
Roof/shelter	SF	29,000	25.17	(730,000)
Fire Protection				495,000
Sprinklers	Ls	---	---	(70,000)
Halon	LS	---	---	(220,000)
Detection	LS	---	---	(110,000)
Controls	LS	---	---	(95,000)
Mechanical				4,020,000
Air handling units	LS	---	---	(1,000,000)
Air distribution ducts	Ls	---	---	(2,060,000)
Insulation	Ls	---	---	(310,000)
Plumbing	Ls	---	---	(150,000)
Instrumentation and controls	Ls	---	---	(500,000)

	Unit of Measure	Quantity	Unit Cost	cost
Electrical				1,895,000
Substation	LS	---	---	(85,000)
Switchboards and controls	Ls	---	---	(350,000)
Power distribution	SF	87,000	13.74	(1,195,000)
Lighting	Ls	---	---	(265,000)
Equipment	---	---	---	---
Fallout Shelter (not feasible).	---	---	---	---
Total				9,300,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Proposed Zoning and Exiting Floors, 2 and 3

OTHER EQUIPMENT SUMMARY:

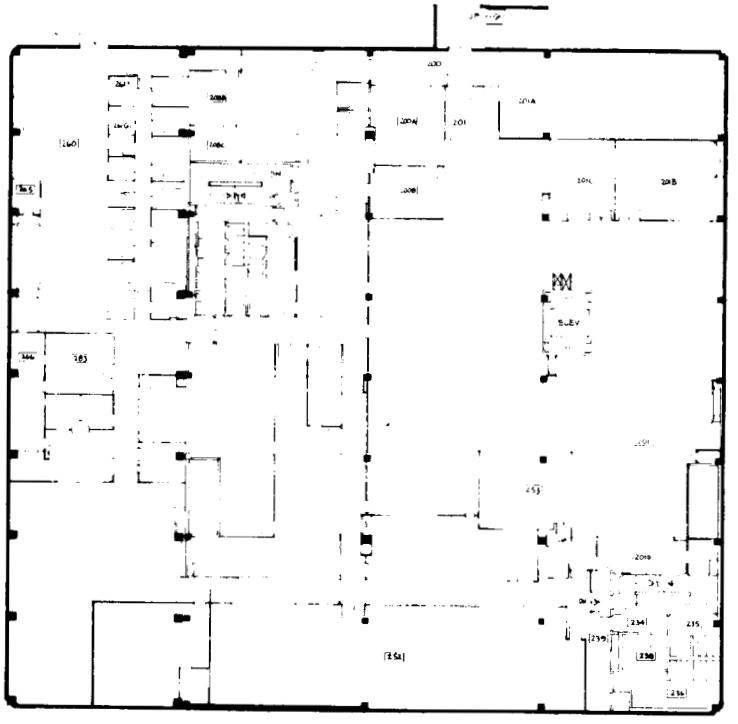
Equipment relocation and installation estimated to cost $1 million, will be provided from Research and Development funds.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Additional funding for the second and third floors is not anticipated. However, future modification work is anticipated for the basement and first floors of the SFOF and is estimated to cost about $8.5 million.

JET PROPULSION LABORATORY
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO SPACE FLIGHT OPERATIONS FACILITY (230)

PROPOSED ZONING AND EXITING
FLOORS 2 AND 3



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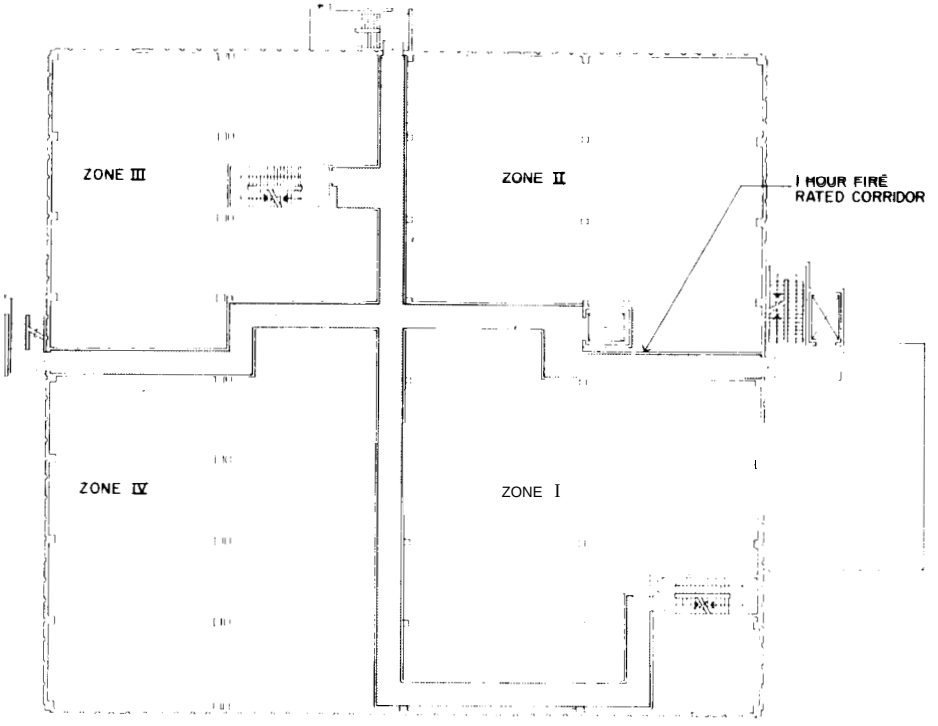

AFTER

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FIGURE 2

JOHNSON
SPACE CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

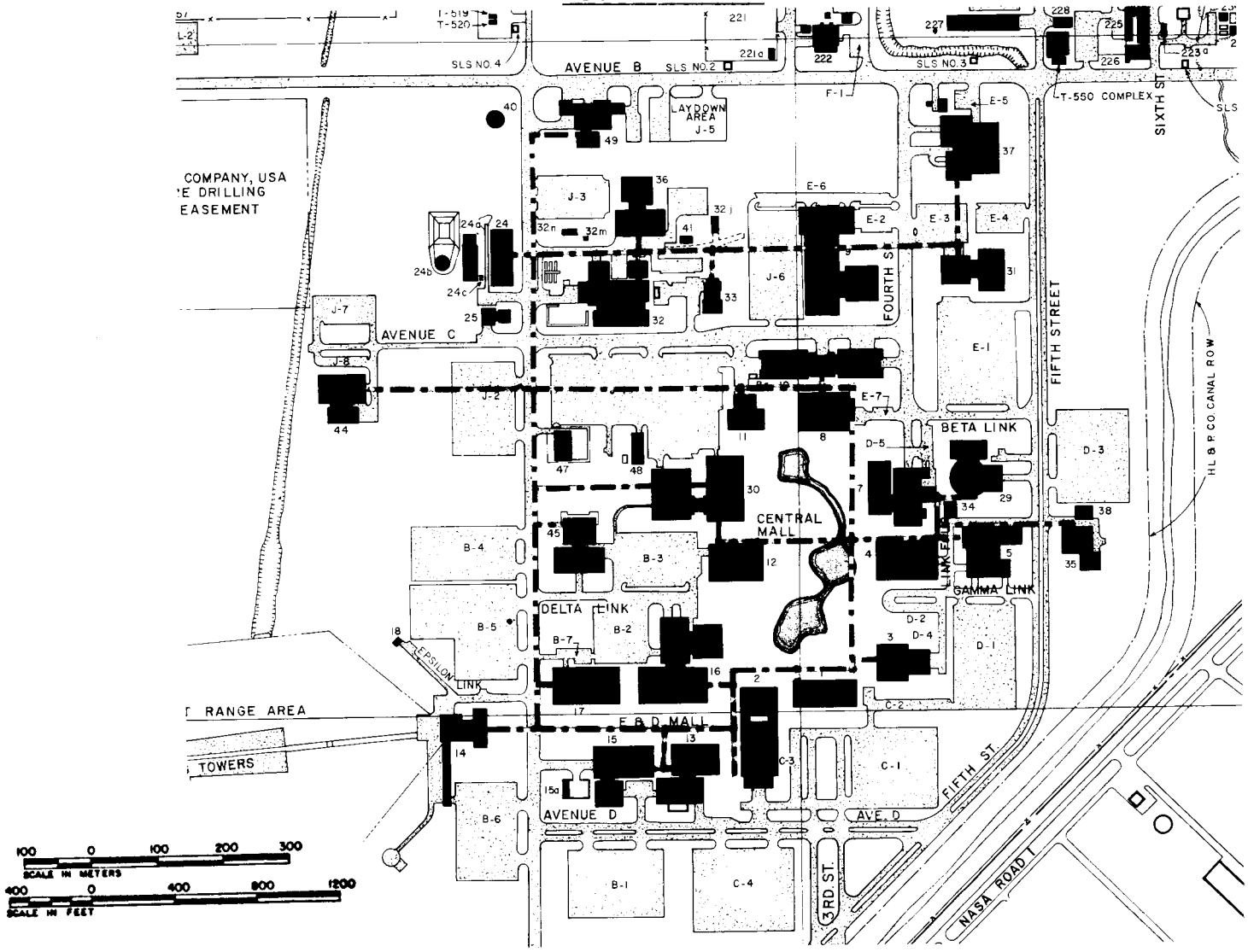
LYNDON B. JOHNSON SPACE CENTER

	Amount	Page No.
Office of the Comptroller:		
Rehabilitation of Utility Control System, Various Buildings.....	680,000	CF 4-1

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1982 ESTIMATES

REHABILITATION OF UTILITY CONTROL SYSTEM, VARIOUS BUILDINGS

LOCATION PLAN



CF 4-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Rehabilitation of Utility Control System, Various Buildings

INSTALLATION: Lyndon B. Johnson Space Center

FY 1982 CoF ESTIMATE: $680,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	84,000	1,263,000*	1,347,000
Capitalized investment	N/A		---
Total	84,000	1,263,000	1,347,000

*Mixed in with other systems and funding is not separately identifiable.

SUMMARY PURPOSE AND SCOPE:

This is the final phase of a multiyear program to upgrade the Utility Control System (UCS) in 32 buildings served by a Central Processing Unit in the Heating and Cooling Plant, Building 24, at Johnson Space Center (JSC). This phase provides for rehabilitation of the UCS in the final 15 buildings of 32. Rehabilitation includes the replacement of obsolete data acquisition equipment with new state-of-the-art remote terminal units (RTU). Work also includes modifications necessary to interconnect the RTU's to the Central Processing Unit in Building 24, and to existing sensors in various buildings.

PROJECT JUSTIFICATION:

This project is required because the existing UCS data acquisition units are obsolete and their performance has been degraded to a point where they provide marginal service. Frequent failures result in considerable downtime and require continuous maintenance. The low reliability of these units results in erroneous and missing data which causes poor utility management and energy waste. The existing units are no longer being manufactured and replacement electronic printed circuit cards must be fabricated at considerable cost. Replacement of these units is less costly than the present maintenance methods and will provide the reliability needed to adequately manage energy resources. In addition to energy management, the new equipment will be used to monitor and control environmental support equipment. The upgraded RTU's will be located in each building and will provide complete monitoring and control of facility utility equipment.

This project will complete the upgrade of the existing UCS. Without this final increment, JSC would be required to operate two UCS systems; the old system which is now serving 15 buildings and the previously upgraded system which is serving 17 buildings. Two computers and two operators would be required. The awkwardness of this situation would require extra manpower and cause inefficient energy management.

IMPACT OF DELAY:

If this phase to upgrade the final 15 buildings is delayed, a dual system operation will be required that will use more manpower and waste energy. System reliability would be sacrificed and if one computer shutdown, half the system would not operate.

PROJECT DESCRIPTION:

This project is the final phase of a multiyear program to replace obsolete equipment in the data acquisition portion of the UCS with state-of-the-art RTU's. The work in this phase includes the replacement of the data acquisition terminals in 15 buildings (Figure 1) with new RTU's that have data acqusition and control capability. The proposed units will be of the latest state-of-the-art design, but functionally similar to the existing units. Also included in the project is the interconnecting of RTU's to the existing Central Processing Unit in Building 24 and to the existing sensors in each building.

PROJECT COST ESTIMATE:

This cost estimate is based on in-house engineering estimates.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	*230,000*
Installation of remote terminal units.	EA	15	15,330	*230,*000
Equipment	---	---	---	450,000
Remote terminal units	EA	15	30,000	450,000
Fallout Shelter (not feasible)	---	---	---	---
Total				680,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY:

No additional equipment is required for this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

KENNEDY
SPACE CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

JOHN F. KENNEDY SPACE CENTER

	Amount	Page No.
Office of the Controller:		
Construction of Waste Material Incinerator	895,000	CF 5-1
Rehabilitation and Modification of Various Buildings	840,000	CF 5-8
Repair of Operations and Checkout Building Roof	825,000	CF 5-17
Total	2,560,000	

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
CONSTRUCTION OF WASTE MATERIAL INCINERATOR

LOCATION PLAN

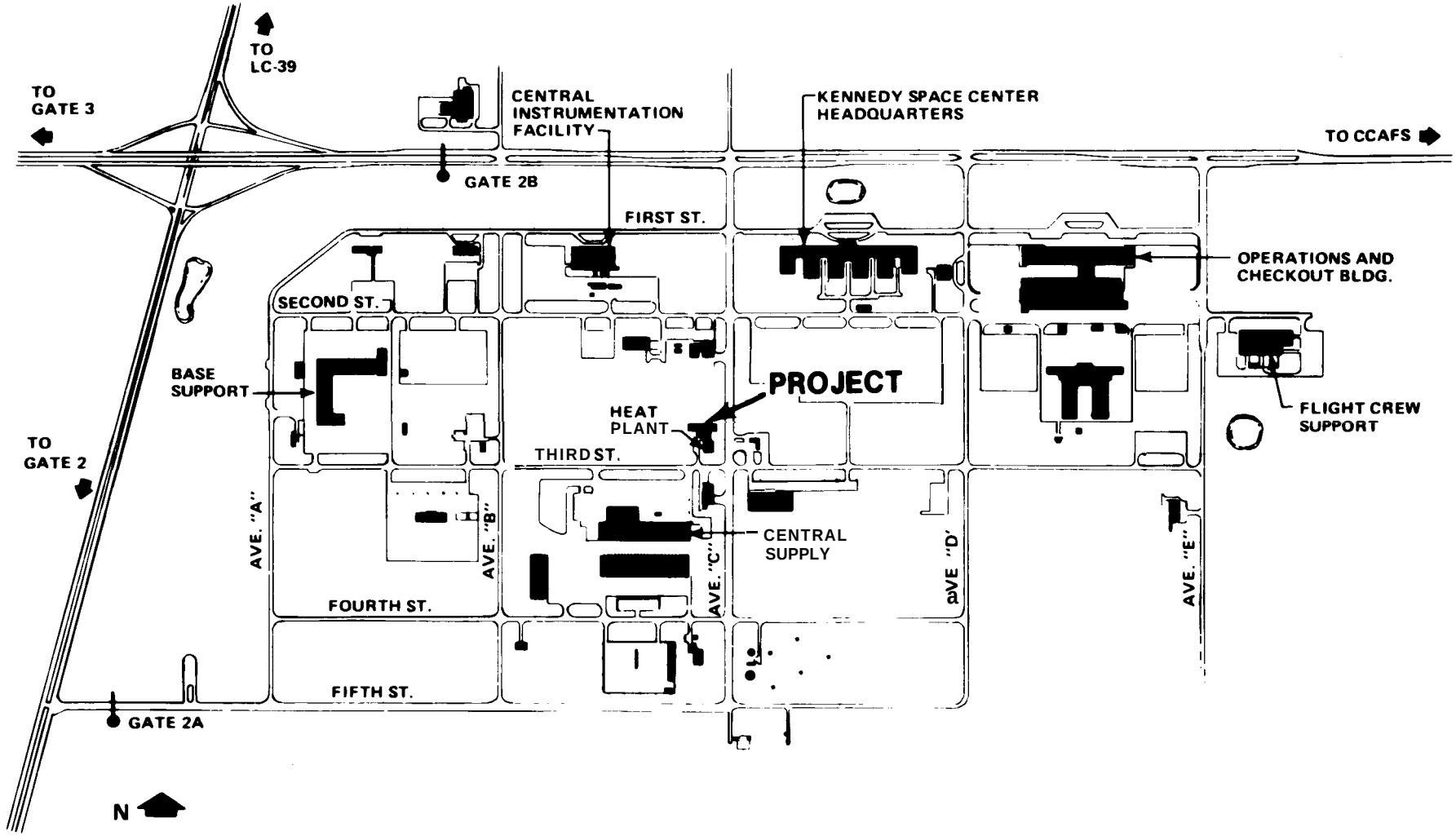


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Construction of Waste Material Incinerator

INSTALLATION: John F. Kennedy Space Center

FY 1982 CoF ESTIMATE: $895,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	126,900	---	126,900
Capitalized investment	N/A	---	---
Total	126,900	---	126,900

SUMMARY PURPOSE AND SCOPE:

This project will provide a continuous feed waste material incinerator adjacent to the Kennedy Space Center (KSC) Central Heating Plant (Figure 1). The incinerator will burn KSC-generated waste paper which is now disposed of daily in the KSC landfill. The heat energy from the incinerator will be used to produce high temperature hot water to augment the existing high temperature hot water system servicing the KSC industrial area. This system will result in a net annual decrease in fuel oil consumption at KSC and has a payback period of 2.2 years.

PROJECT JUSTIFICATION:

The incinerator will provide a savings of approximately 573,000 gallons (2,168,000 liters) of t6 fuel oil each year which otherwise would be required by the Central Heating Plant in generating high temperature hot water in the KSC industrial area. This output amounts to about 66 percent of the total demand of the Central Heating Plant and corresponds to a gross savings of $430,000, or 86 billion Btu's, in the first year of operation. These savings, coupled with incinerator operating costs, will yield a net annual savings of at least $418,000. Additionally, the incinerator will allow a 90 percent reduction in the quantity of waste materials to be disposed of in the KSC landfill. The project payback period is 2.2 years.

IMPACT OF DELAY:

Delay of this project will result in continuance of unnecessary energy consumption for the production of high temperature hot water at KSC, failure to capture the energy potential of waste material, and shortening the useful life of the KSC landfill.

PROJECT DESCRIPTION:

This project provides a waste refuse incinerator/energy recovery system to the KSC Central Heating Plant (Figure 2). The system includes a 16-ton (14.4 metric ton) per day continuous burning waste refuse incinerator which will be capable of accepting a force-fed rate of 20 tons (18.1 metric tons) per day. The incinerator will be augmented by a tube-type heat exchanger in the hot gas exhaust (Figure 3) to reheat Central Heating Plant return water to 325°F (163°C). The project includes controls and 450 linear feet (137.2 meters) of 6-inch (15.3 centimeter) insulated high temperature hot water piping to connect the heat exchanger to the existing system. Utilities to the incinerator will include 440V, 3-phase, 300 and 150 amp electric service; 270 linear feet (82.3 meters) of 2-inch (5.1 centimeter) steel pipe water line; and 230 linear feet (70.1 meters) of 6-inch (15.3 centimeter) vitrified clay sewer line. Fuel oil for startup will be supplied by 225 linear feet (68.6 meters) of 1 and 1/2-inch (3.8 centimeter) steel pipe that will be connected to nearby storage tanks. Immediately adjacent to and north of the incinerator will be a 40-foot (12.2 meter) by 60-foot (18.3 meter) by 18-foot (5.5 meter) clear height prefabricated metal building. The building will have a concrete floor and be used for the transfer of refuse from collection trucks to the incinerator. A short access road will be constructed to connect the existing roadway with the transfer building.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	416,000
Building	SF	2,400	80.83	194,000
Sitework	LS	---	---	36,000
Mechanical	LS	---	---	134,000
Electrical	LS	---	---	52,000
Equipment	---	---	---	479,000
Incinerator	EA	1	---	479,000
Fallout Shelter (not feasible)	---	---	---	---
Total				895,000

LIST OF RELATED GRAPHICS:

Figure I - Location Plan
Figure 2 - Site Plan
Figure 3 - Pictorial View

OTHER EQUIPMENT SUMMARY:

Two front-end loaders and two "load-all" trash containers are required to make the facility operational. These are estimated to cost $27,500 and will be funded from the R&PM account.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is planned for this facility.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
CONSTRUCTION OF WASTE MATERIAL INCINERATOR

SITE PLAN

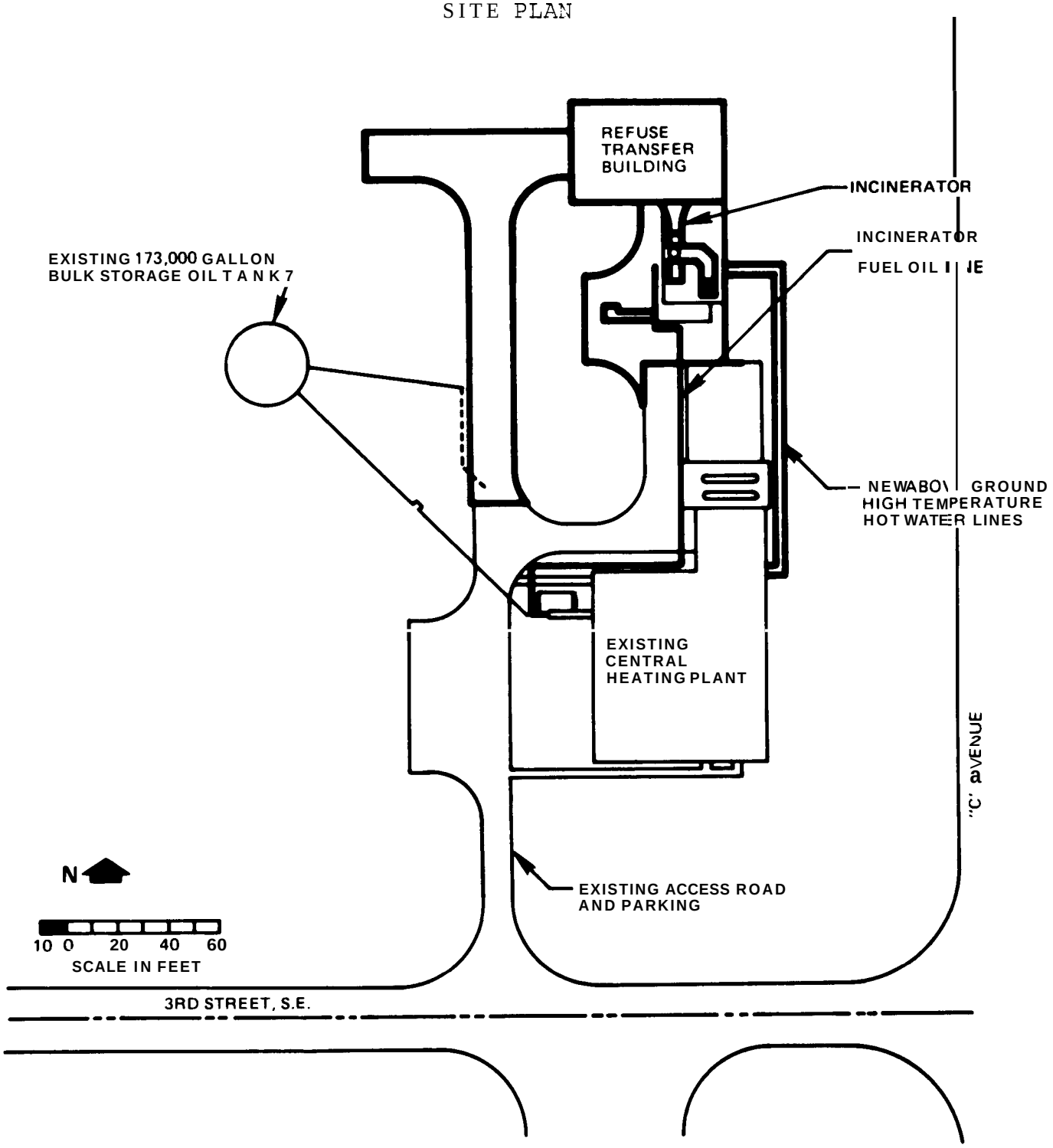


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
CONSTRUCTION OF WASTE MATERIAL INCINERATOR

PICTORIAL VIEW

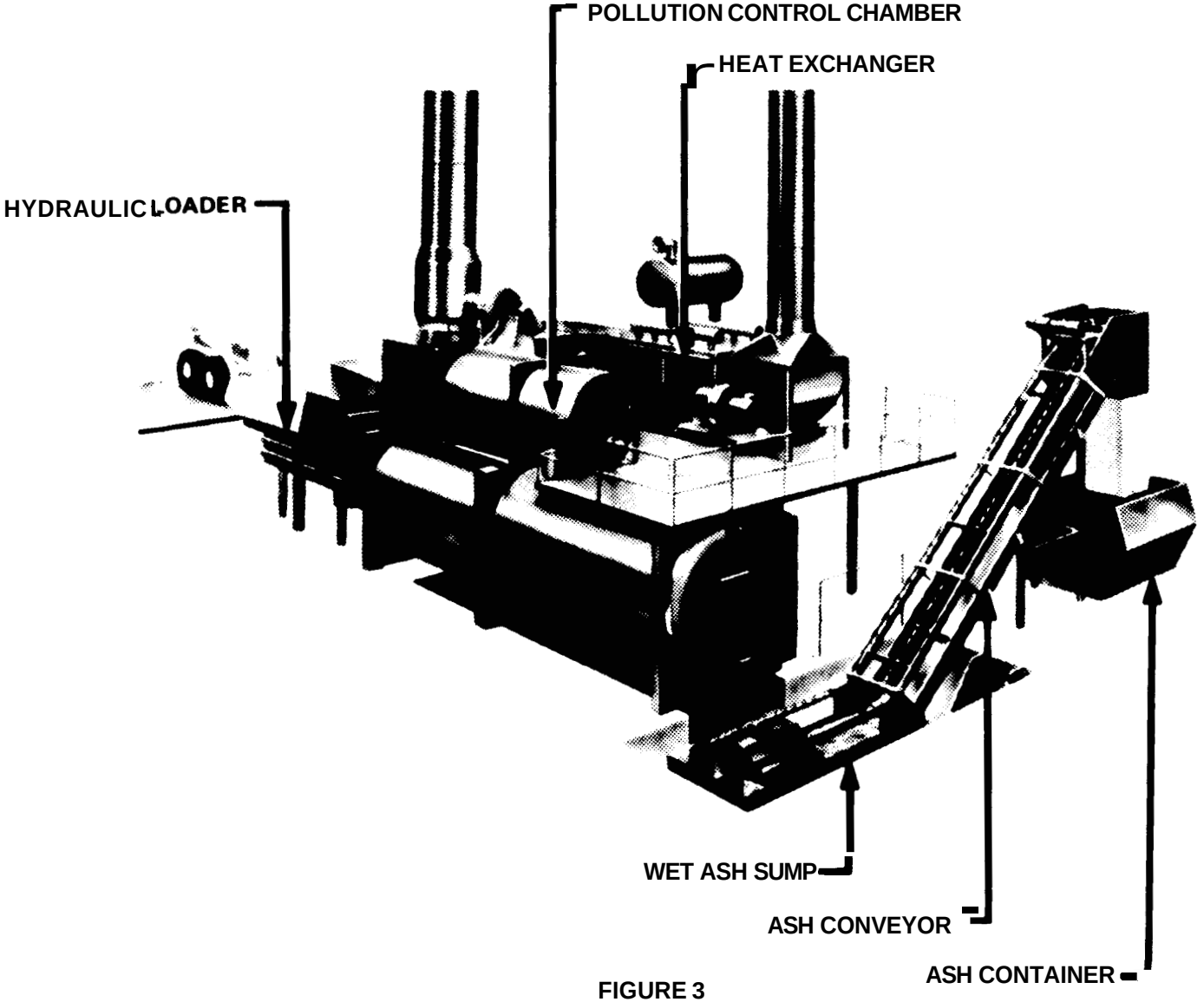


FIGURE 3

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
REHABILITATION AND MODIFICATION OF VARIOUS BUILDINGS
LOCATION PLAN

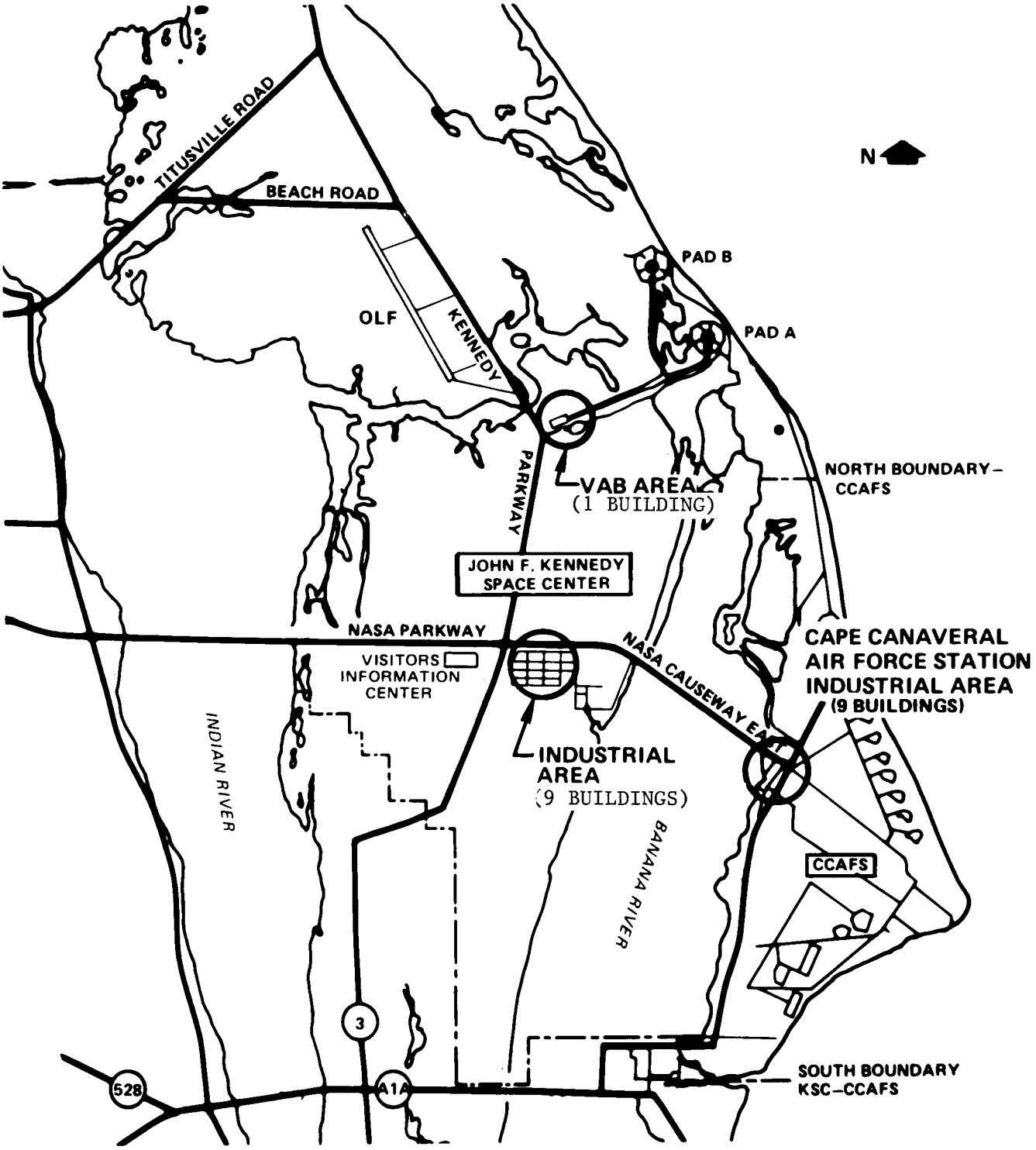


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification of Various Buildings

INSTALLATION: John F. Kennedy Space Center

FY 1982 CoF ESTIMATE: $840,000

LOCATION OF PROJECT: John F. Kennedy Space, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	110,000	---	110,000
Capitalized investment	N/A	26,792,655	26,792,655
Total	110,000	26,792,655	26,902,655

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to the heating, ventilating and air-conditioning (HVAC) systems, as well as other related energy reduction initiatives in nineteen (19) buildings (Figure 1) which support the Space Transportation System (STS), payloads and expendable vehicle missions at the Kennedy Space Center (KSC). This work is necessaryto reduce energy consumption at KSC to levels necessarytomaintain essential environmental conditions for personnel, hardware, and .equipment. The planned modifications to the HVAC systems include changes to air handling systems to adjust the air flow rate, combining selected existing air handler units and compressors to improve utilization factors, modification of controls, reduction of the rate of air change in

high bays and airlock clean rooms, and modifications to duct and piping systems. Also included are modifications to various architectural features to reduce heat and cooling loads, such as the resealing or weatherstripping of doors and windows, and insulating metal panels in doors and walls.

PROJECT JUSTIFICATION:

The nineteen buildings included in this project support NASA's operations at Kennedy Space Center and Cape Canaveral Air Force Station. These facilities house laboratories, shops, clean rooms, assembly areas, office space and personnel support functions which are critical to the Shuttle, payload and expendable vehicle operations.

As originally designed and constructed, most of these facilities have more heating, ventilating and cooling capacities than are necessary to support current or future mission requirements. Since originally constructed, space utilization has changed in most buildings and, in some cases, significantly. The HVAC systems currently installed in these buildings generally exceed the capacity required to provide an adequate working environment to support present or future planned programs. Significant energy savings in the operation of these facilities can be achieved through various modifications to the HVAC and electrical system, and architectural features of the buildings. Implementation of this project will result in a savings of 54 billion Btu's, valued at over $290,000 per year starting in the first year of operation. The project simple payback period is less than 3 years.

IMPACT OF DELAY:

Failure to implement this project at this time will delay achievement of these energy and cost reductions, and result in continued waste of energy at ever increasing costs. The modifications must be made as soon as possible to minimize .interruptions to STS related activities. As future STS flight rates increase, it will become increasingly more difficult to schedule this work on a noninterference basis.

PROJECT DESCRIPTION:

This project provides energy conservation modifications to one (1) building in the Vehicle Assembly Building (VAB) area (Figure 2), nine (9) buildings in the Industrial Area (Figure 3) on Kennedy Space Center, and nine (9) buildings at Cape Canaveral Air Force Station Industrial Area (Figure 4). These modifications consist of five main work categories: modifying/installing HVAC controls and timers; reducing air circulation rates; replacing/eliminating oversized mechanical units; modifying electrical systems;and installing weatherstripping and/or insulation.

On-off timers and other controls on HVAC equipment will allow selective minimum use of this equpment and provide a positive off control during nonworking periods. This is particulary cost-effective in areas of intermittant usage. Timers and/or controls will be installed in Buildings M7-351, 60530, 1728, and 1385A.

Many air handling units (AHU's) throughout KSC provide air circulation rates that are higher than required. By replacing motors, sheaves, and/or pullies on these AHU's, circulation rates will be reduced to more closely match the required loads and the equipment will require less energy. These types of modifications will be made in Buildings M6-495 and M6-339.

For items of HVAC equipment (compressors, blower motors, condensers, exhaust fans) that are to grossly oversized to handle present or envisioned requirements, the only course of action to save energy is to replace the item with one of lesser capacity. Replacement of equipment will be made in Buildings M6-138, M6-493, M7-657, 1726, 21900A, and 49635.

Fluorescent lighting is more energy efficient than incandescent lighting. In Building 66220, the lighting systems will be changed to fluorescent lighting.

Insulation and weatherstripping to minimize energy tranfers through exterior surfaces and to reduce the loss of conditioned air from a facility will be made to Buildings M7-1061, M7-1212, M6-791, 21900H, and 55005.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	840,000
KSC VAB Area:				
Building K7-516, propellant laboratory and gas maintenance shop	LS	---	---	28,000
KSC Industrial Area:				
Building M6-138, communications distribution and switching center	LS	---	---	90,000
Building M6-493, cafeteria	LS	---	---	35,000
Building M6-495, dispensary	LS	---	---	26,000
Building M7-351, auditorium and training facility	LS	---	---	33,000
Building M7-961, hypergol processing facility, north	LS	---	---	145,000
Building M7-1061, hypergol support facility	LS	---	---	55,000
Building M7-1212, hypergol processing facility, south	LS	---	---	38,000
Building M7-657, parachute refurbishment facility	LS	---	---	92,000
Building M6-339, communications office	LS	---	---	5,000

	Unit of Measure	Quantity	Unit cost	cost
Cape Canaveral Air Force Station (CCAFS)				
Building 1726, hangar "S"	LS	---	---	102,000
Building 60530, hanger "AO"	LS	---	---	73,000
Building 21900H, records storage building	LS	---	---	10,000
Building 1728, hangar N	LS	---	---	15,000
Building 1385A, mission control center	LS	---	---	
Building 21900A, blockhouse 34	LS	---	---	22,000
Building 55005, lab and engineering building	LS	---	---	30,000
Building 49635, CCAFS dispensary	LS	---	---	23,000
Building 66220, passivation building	LS	---	---	10,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				840,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan, VAB Area
Figure 3 - Site Plan, Kennedy Space Center Industrial Area
Figure 4 - Site Plan, Cape Canaveral Air Force Station Industrial Area

OTHER EQUIPMENT SUMMARY:

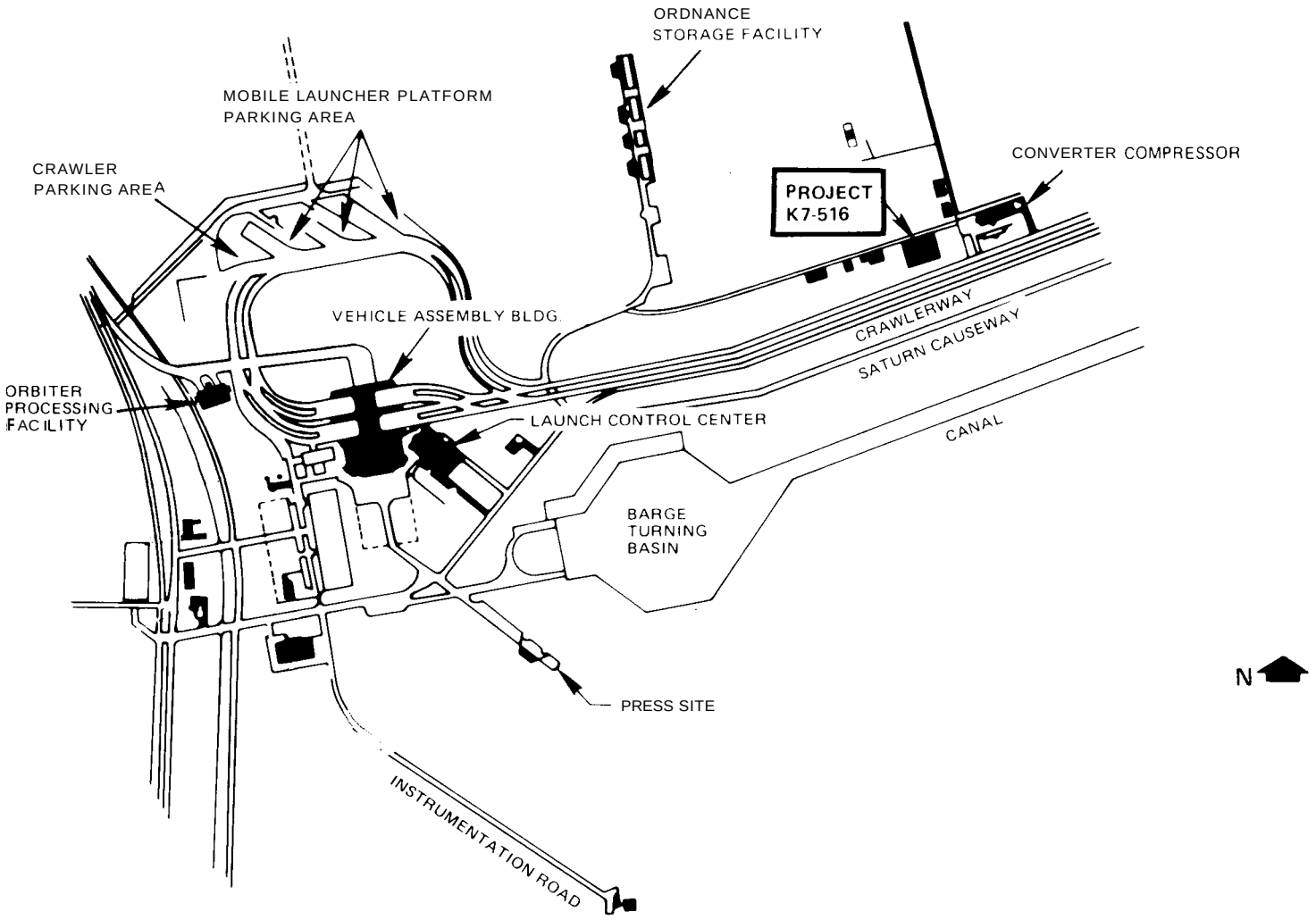
No other equipment is required for this facility project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No additional funding is required to complete this project. Additional energy conservation modifications to facilities at KSC are being planned for future years.

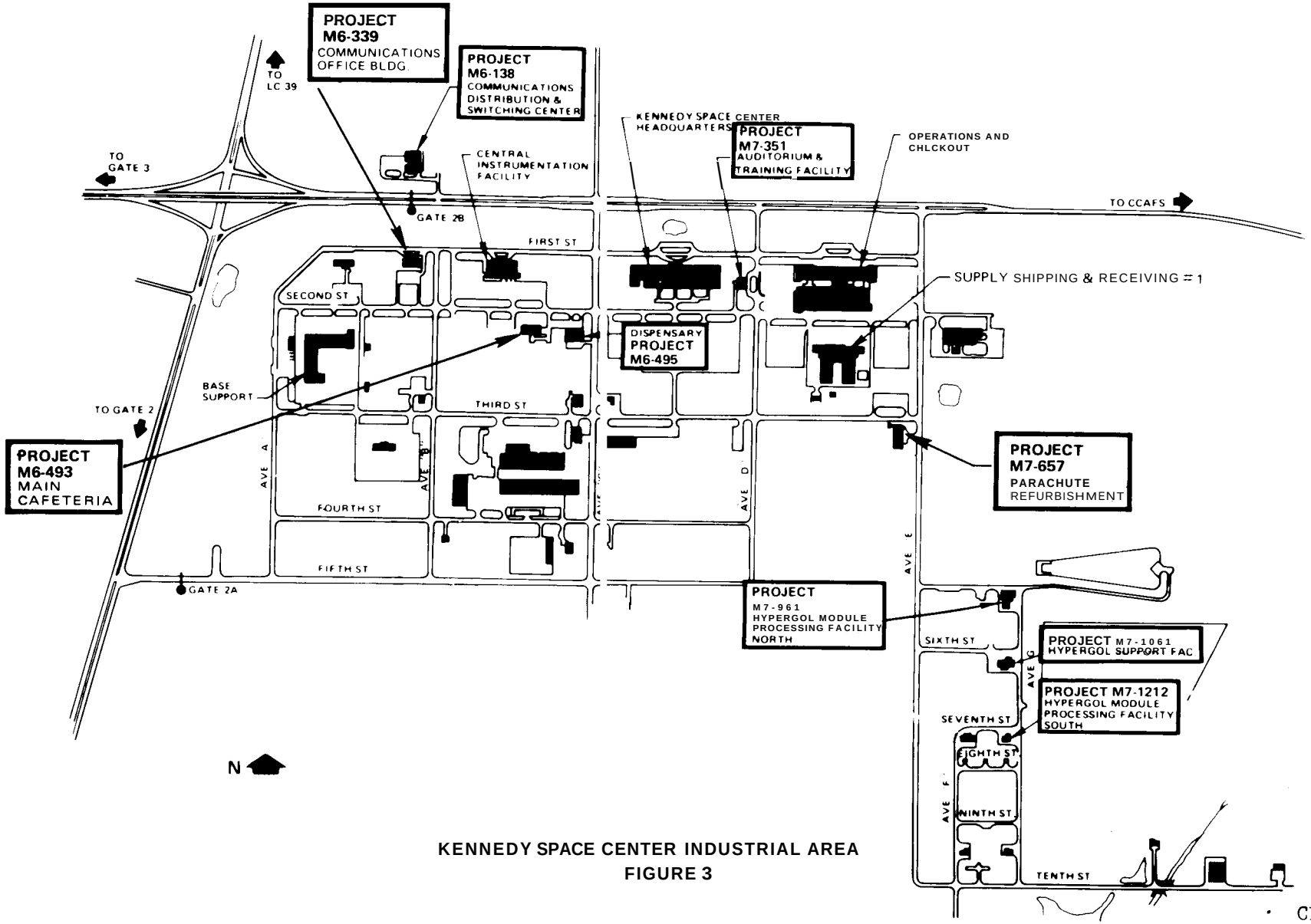
JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
REHABILITATION AND MODIFICATION OF VARIOUS BUILDINGS

SITE PLAN



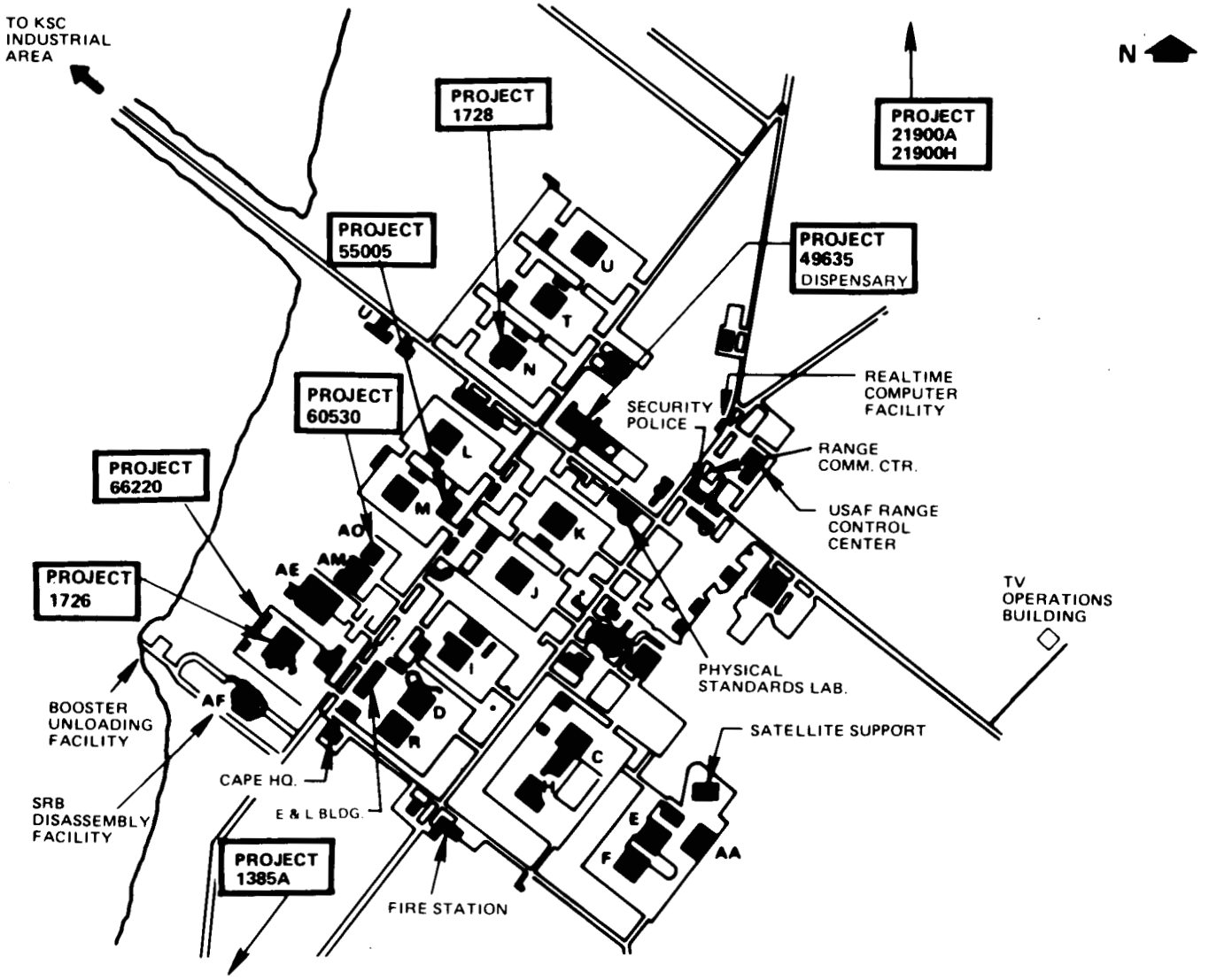
KENNEDY SPACE CENTER VAB AREA
FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
REHABILITATION AND MODIFICATION OF VARIOUS BUILDINGS
SITE PLAN



KENNEDY SPACE CENTER INDUSTRIAL AREA
FIGURE 3

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
REHABILITATION MODIFICATION OF VARIOUS BUILDINGS
SITE PLAN



CAPE CANAVERAL AIR FORCE STATION INDUSTRIAL AREA
FIGURE 4

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
REPAIR OF OPERATIONS AND CHECKOUT BUILDING ROOF

LOCATION PLAN

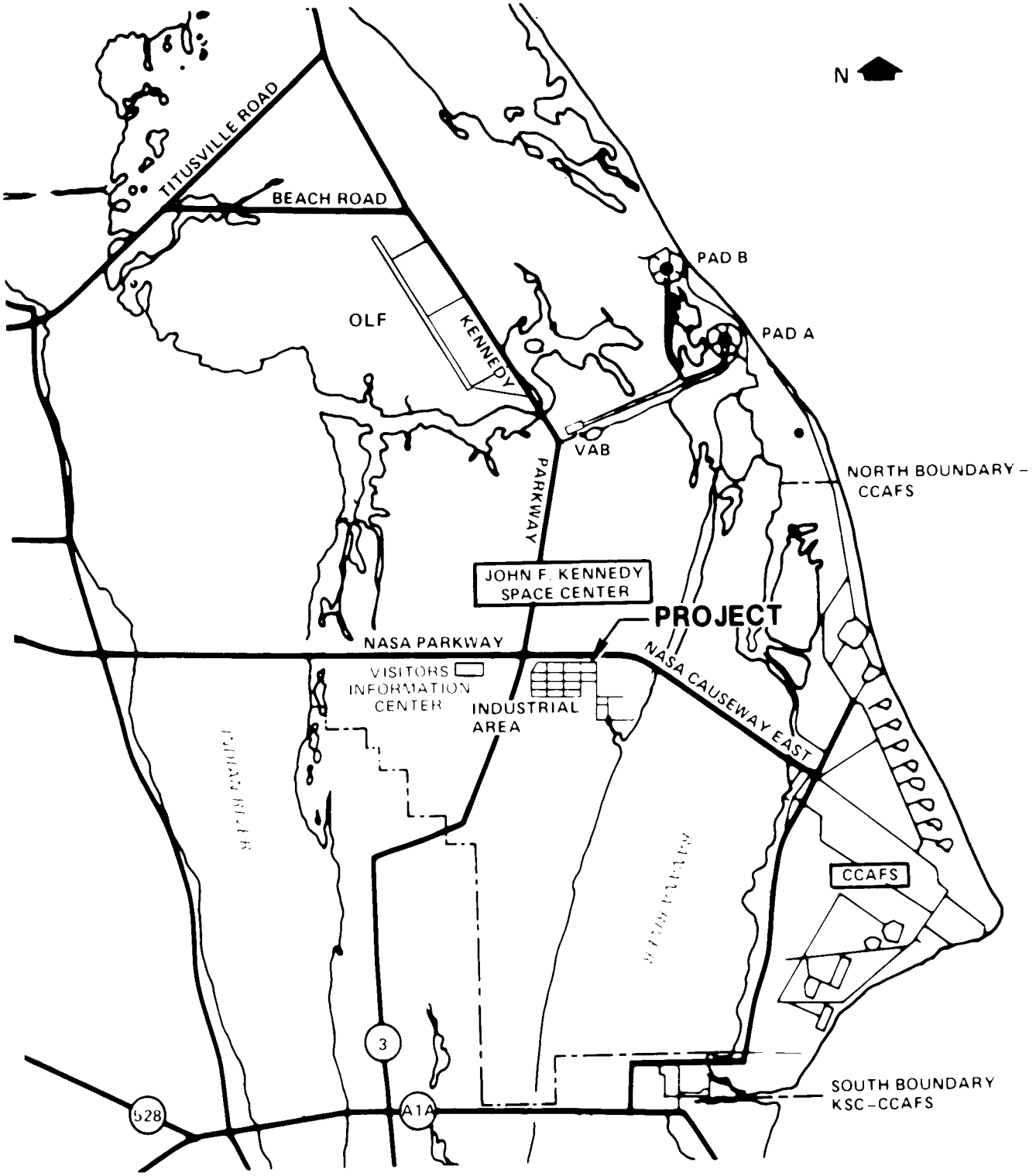


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Repair of Operations and Checkout Building Roof

INSTALLATION: John F. Kennedy Space Center

FY 1982 CoF ESTIMATE: $825,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	64,000	---	64,000
Capitalized investment	N/A	46,399,851	46,399,851
Total	64,000	46,399,851	46,463,851

SUMMARY PURPOSE AND SCOPE:

This project provides for the repair of 197,000 square feet (17,730 square meters) of roof on the Operations and Checkout Building at the Kennedy Space Center (Figures 1 and 2). Repair of the most severely deteriorated roof areas over the high bay and fifth floor of this building was authorized previously in the FY 1981 program and included approximately one-fifth of the total roof area. To alleviate advancing decomposition and resultant damage to building contents, it is essential that the balance of the roof be repaired in Fiscal Year 1982. This proposed work includes roof surface preparation: repair of all blisters, cracks and splits: flashing repairs: roof mat treatment: and replacement of aggregate (Figure 3).

PROJECT JUSTIFICATION:

The Operations and Checkout Building is the primary facility used at the Kennedy Space Center for the assembly and checkout of all horizontally prepared Shuttle payloads, including Spacelab. The facility houses payload experiment integration workstands, Spacelab workstands, control rooms, computers, laboratories, clean rooms and other mechanical and electrical equipment used to support Shuttle payload operations. It is imperative that this facility be maintained in sound condition to meet Space Transportation System (STS) programmatic demands.

The roof system has not been rehabilitated since originally constructed in 1964. Accrued deterioration has led to increasingly frequent spot repairs over the last several years to protect the structural integrity of the building and to prevent damage due to leaks. A moisture condition survey was prepared by an architect-engineering firm in mid-1979 which showed that moisture penetration of large areas of the roof had taken place. This excessive moisture condition requires that the roof be repaired at this time to preclude more serious damage in the future.

IMPACT OF DELAY:

Delaying the repair of the roof will subject the building, its contents and horizontal payload processing to damage and/or prolonged interruption of activities from water leakage. Deterioration that can be expected to take place if not repaired now will result in even greater repair costs at a later date.

PROJECT DESCRIPTION:

This project provides for the repair of approximately 197,000 square feet (17,730 square meters) of roof area. The proposed work includes: removal of all loose gravel, dirt and foreign matter; appropriate repairs to eliminate blisters, breaks, splits, buckles and ridges; replacement of deteriorated felts; repair of composition base flashing around ventilators; and replacement of gravel stop slip joint seam caulking. When these repairs are completed, the entire area will be treated with an asphaltic base material, and the aggregate cover will be replaced.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report and related studies.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	825,000
Architectural/structural	SF	197,000	4.19	825,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				825,000

LIST OF RELATED GRAPHICS

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Building Perspective

OTHER EQUIPMENT SUMMARY

No other equipment is required for this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There is no future funding required to complete this project.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
REPAIR OF OPERATIONS AND CHECKOUT BUILDING ROOF

SITE PLAN

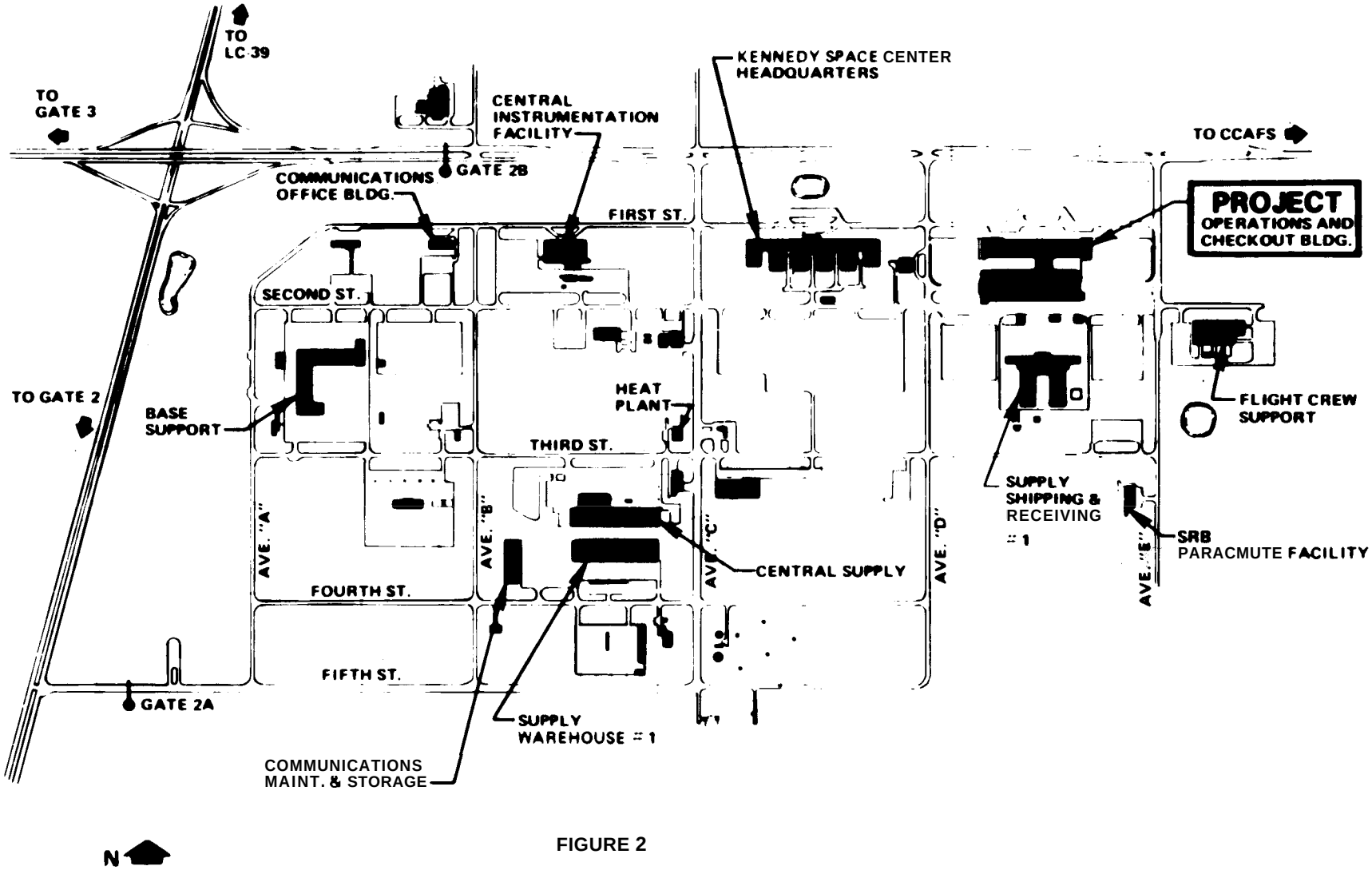


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
REPAIR OF OPERATIONS AND CHECKOUT BUILDING ROOF

PERSPECTIVE

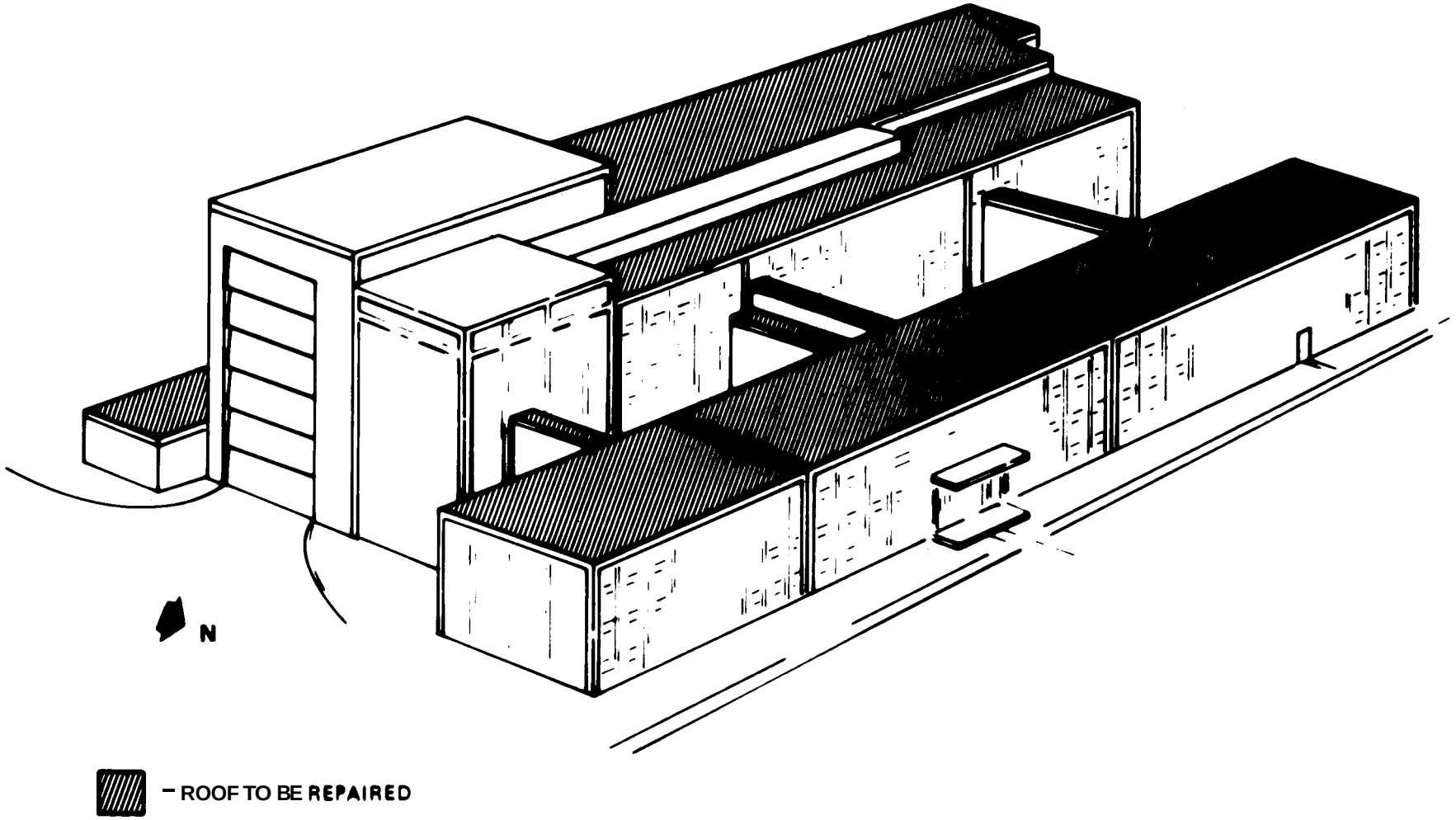


FIGURE 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

LANGLEY RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Modifications for Enhanced 20-Inch Supersonic Wind Tunnel (1247 D)	2,950,000	CF 6-1
Modifications to Mach 19 Nitrogen Tunnel (1247 B)	1,760,000	CF 6-9
Modification of Transonic Dynamics Tunnel (648)	8,000,000	CF 6-17
Total	12,710,000	

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR ENHANCED 20-INCH SUPERSONIC WIND TUNNEL (1247D)
LOCATION PLAN

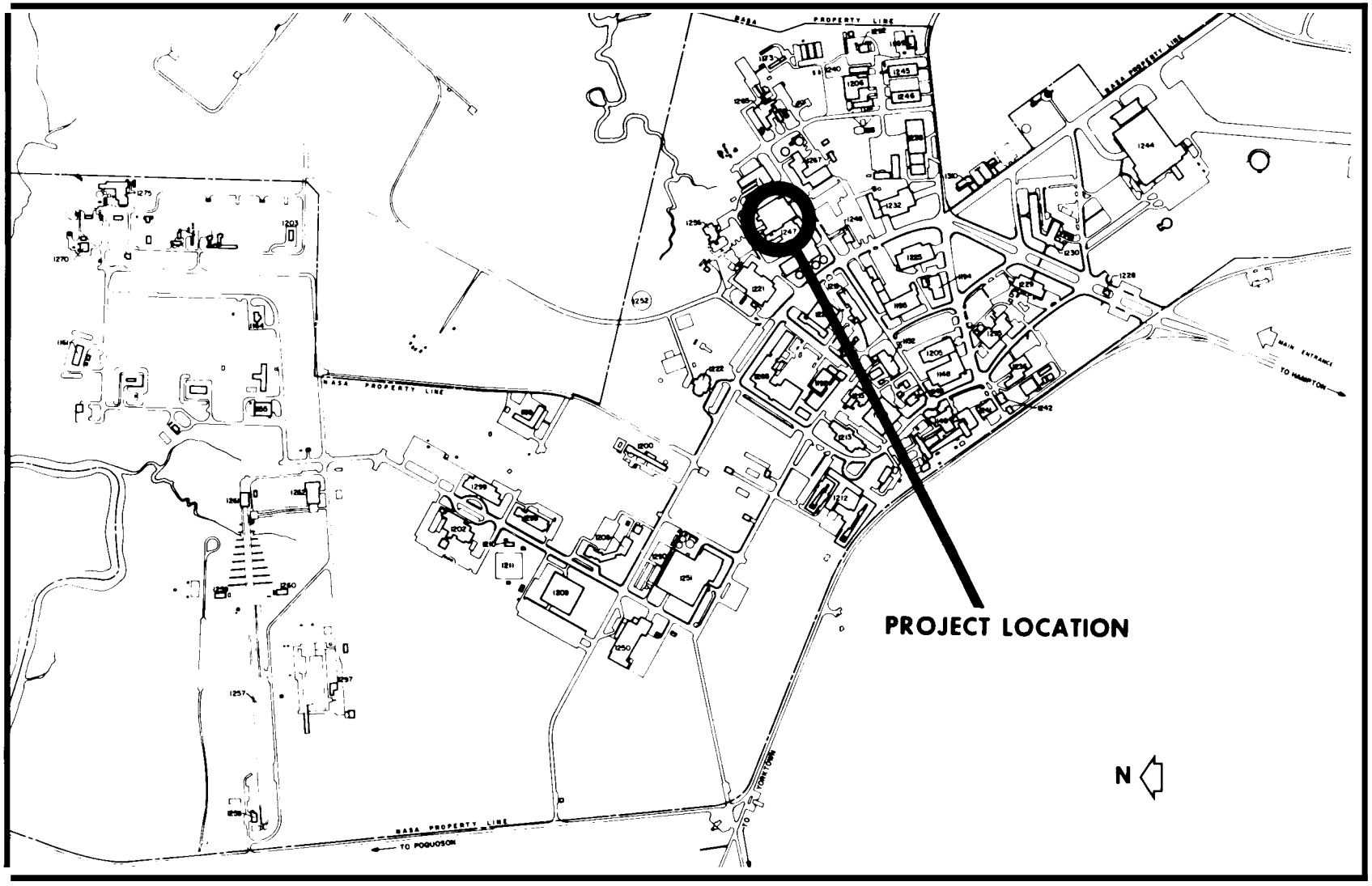


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Modifications for Enhanced 20-Inch Supersonic Wind Tunnel (1247D)

INSTALLATION: Langley Research Center

FY 1982 CoF ESTIMATE: $2,950,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	306,000	---	306,000
Capitalized investment	N/A	600,000	600,000
Total	306,000	600,000	906,000

SUMMARY PURPOSE AND SCOPE:

This project will provide an expanded capability for conducting exploratory aerodynamic testing necessary for supersonic flight research at Langley Research Center (LaRC). The ultimate application of this research will be high-speed, long-range cruising vehicles, supersonic cruise fighters, supersonic cruise missiles, and highly maneuverable air-to-air missiles. Presently, critical areas of research such as sonic boom phenomena, supersonic drag reduction, and supersonic laminar flow control cannot be adequately explored at LaRC because of the lack of a suitable supersonic wind tunnel. This project will combine components from an inactive 20-inch (.5 meter) Jet Propulsion Laboratory (JPL) continuous flow tunnel with existing LaRC high pressure air

supply and vacuum systems to form a 20-inch (.5 meter) supersonic blowdown tunnel. This proposed tunnel will attain test speeds of Mach 1.5 to 4.5, and Reynolds numbers up to 20 million per foot (66 million per meter). It will also have the capability of varying the stagnation temperature for heat transfer testing and the capability of using realistic model exhaust gases for accurate airframe-to-propulsion systems integration testing.

PROJECT JUSTIFICATION:

LaRC is NASA's lead Center for supersonic aerodynamic research, exploratory research relating to high-speed, long-range cruising vehicles, supersonic cruise fighters, and air-to-air missiles. This vital research cannot be conducted adequately because of the lack of a suitable research wind tunnel. This deficiency will be alleviated by this proposed blowdown tunnel with versatile testing capabilities. The proposed tunnel will enable studies in supersonic laminar flow control to identify and develop innovative configurations and/or system changes for long range military and civil aircraft.

The tunnel will complement the Unitary Plan Wind Tunnel (UPWT), which is the only supersonic wind tunnel at LaRC. The UPWT is a large, closed-circuit continuous flow tunnel that is geared for "production" operations and carries a heavy backlog of development work. This proposed "research" tunnel will feature higher quality flow and higher Reynolds numbers than are attainable in the UPWT as well as shorter model change times. It will accommodate realistic model exhaust gases, enable varying of stagnation temperatures, and reach speeds of Mach 1.5 to 4.5. These features are essential for the efficient conduct of innovative research in such areas as: (1) flow-field code validation; (2) airframe-to-propulsion systems integration; (3) studies of the effects of Reynolds number, maneuvering, and performance outside of design specifications on cruise and air-to-air missiles; (4) sonic boom validation; and, (5) supersonic drag reduction and laminar flow control investigations.

The UPWT at LaRC cannot satisfy the requirements because: (1) a higher quality flow is necessary; (2) the UPWT is designed and used for "production" testing instead of exploratory research; (3) the UPWT is four times more costly to operate than the proposed tunnel due to energy and manpower requirements and use of more costly models; (4) the UPWT closed-circuit operation prohibits the use of realistic model exhaust gases for airframe-to-propulsion systems integration studies; (5) the UPWT has a limited capability to vary stagnation temperatures for heat transfer tests; and, (6) extended periods of occupancy for research are not possible because of the UPWT's backlog of development work. The estimated cost of this project which combines components from the inactive 20-inch (0.5 meter) JPL tunnel with LaRC's existing high pressure air supply and vacuum systems is approximately 30 percent of the cost of a new tunnel. The inactive 20-inch (0.5 meter) JPL tunnel in its present configuration as a continuous flow tunnel cannot meet the requirements for research testing. The cost of repowering this tunnel to meet the LaRC requirement is approximately five times the cost of this project.

IMPACT OF DELAY:

The results from research in this proposed tunnel will greatly advance design technology applicable to nigh-speed, long-range cruise vehicles. Such vehicles include future civil and military aircraft, cruise missiles, and highly maneuverable air-to-air missiles. Delay of the project would significantly reduce the level of technology to be incorporated into the design of such vehicles. For example, if supersonic laminar flow control was shown to be practical through experiments in the proposed tunnel, a major reorientation of the Supersonic Cruise Research (SCR) program would occur. The sooner such reorientations are fully explored, the more effective the multi-million dollar SCR program will be.

PROJECT DESCRIPTION:

This project provides for the relocation of components of the inactive 20-inch (0.5 meter) JPL Supersonic Wind Tunnel. These components include the nozzle, test section, diffuser, vacuum piping and Schlieren mirror system. They will be disassembled and shipped to LaRC for installation, modified, and assembled in an existing test room in the Gas Dynamics Laboratory, Building 1247D (Figure 2). Building modifications include floor penetrations at the tunnel frame locations, installation of support pedestals, wall penetrations in the east and west walls for the tunnel settling chamber and diffuser sections, and structural supports and shoring between the tunnel's primary support structure and the existing building foundation (Figure 3). An enclosure for a control room will be provided within the existing test room, and a 420-square foot (39 square meter) balcony for the nozzle control cam system and associated electronic controls will be provided over the control room and the tunnel vacuum piping. Necessary revisions will be made to the building's mechanical and electrical systems, and connections will be made to the existing high pressure air supply and vacuum systems. New equipment, including a quiet throttling valve, a high pressure settling chamber, an air inlet diffuser for reducing flow disturbances and new controls will be installed.

PROJECT COST ESTIMATE:

The project cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	—	—	—	—
Construction	—	—	—	340.000
Building modifications	Ls	—	—	340,000
Equipment	—	—	—	2.61 0.000
Disassemble and ship JPL tunnel components	Ls	—	—	440,000
JPL tunnel section modifications and installation	LS	—	—	1,010,000
Pressure and vacuum piping connections	LS	—	—	295,000
Quiet throttling valve	Ls	—	—	80,000
Settling chamber and inlet diffuser	Ls	—	—	265,000
Controls	LS	—	—	520,000
Fallout Shelter (not feasible)	—	—	—	—
Total				2,950,0000

LIST OF RELATED GRAHPICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Plan View

OTHER EQUIPMENT SUMMARY:

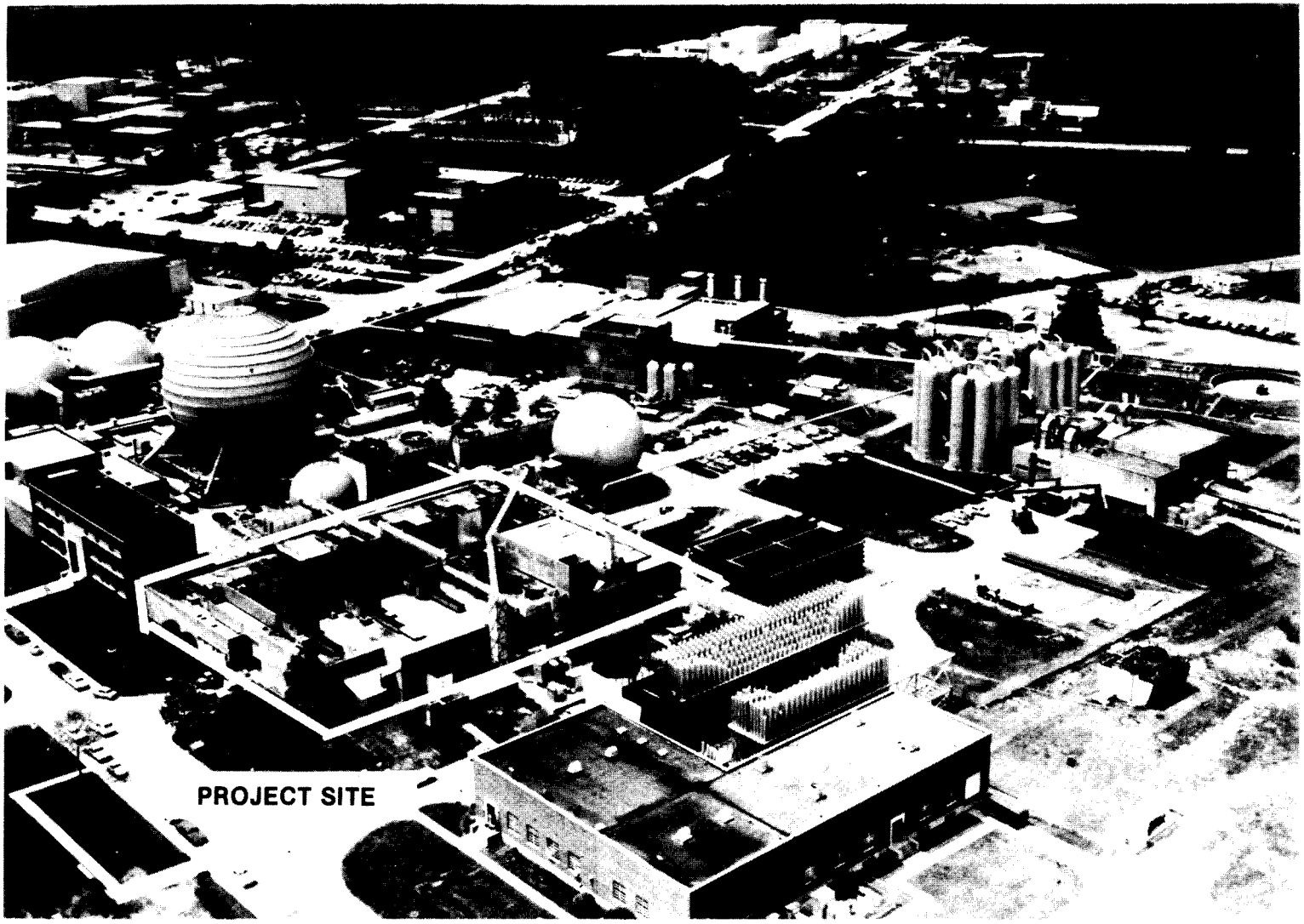
No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR ENHANCED 20-INCH SUPERSONIC WIND TUNNEL (1247D)

SITE PLAN



LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR ENHANCED 20-INCH SUPERSONIC WIND TUNNEL (1247D)
PLAN VIEW

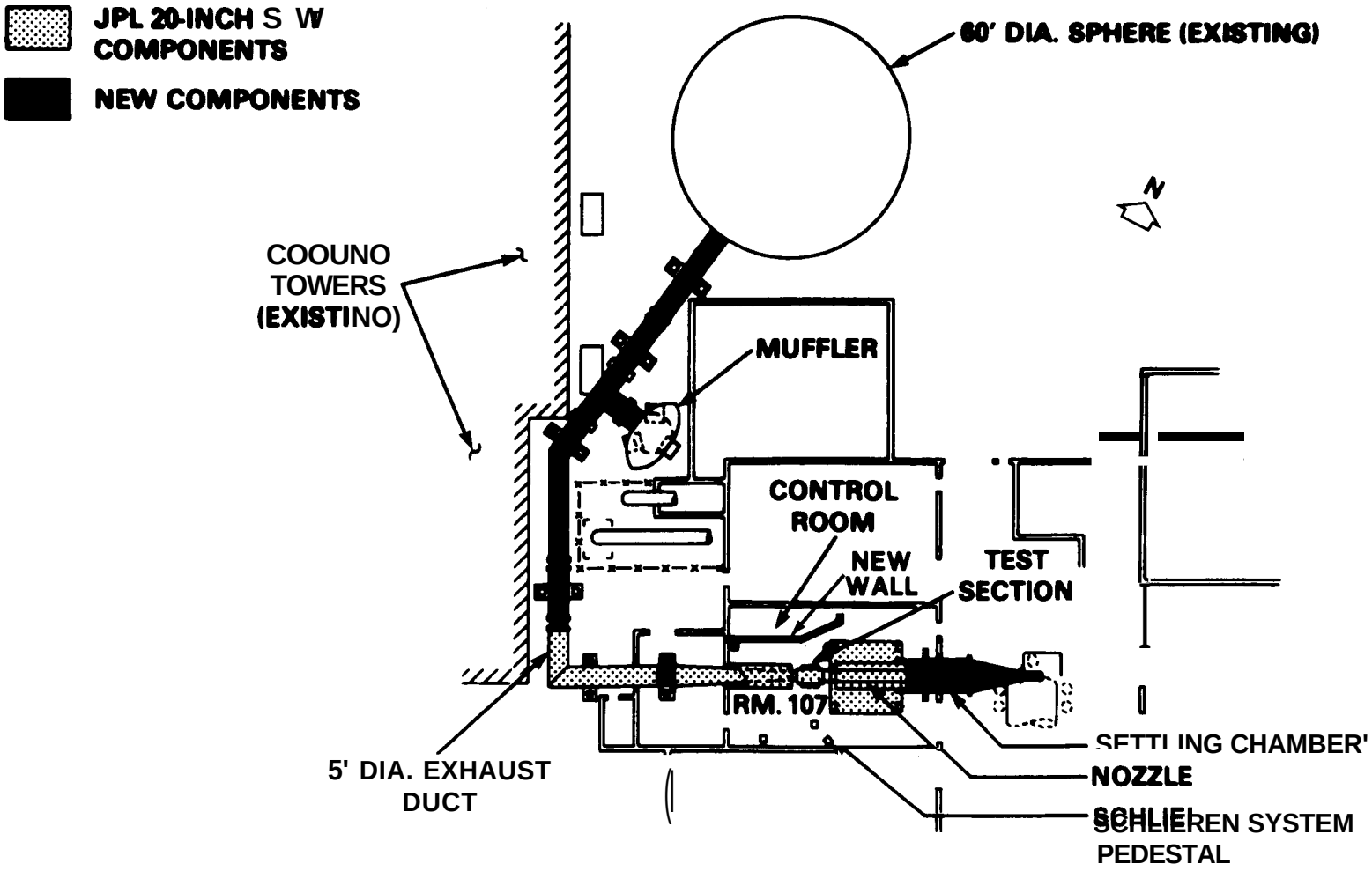


FIGURE 3

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO MACH 19 NITROGEN TUNNEL (12478)

LOCATION PLAN

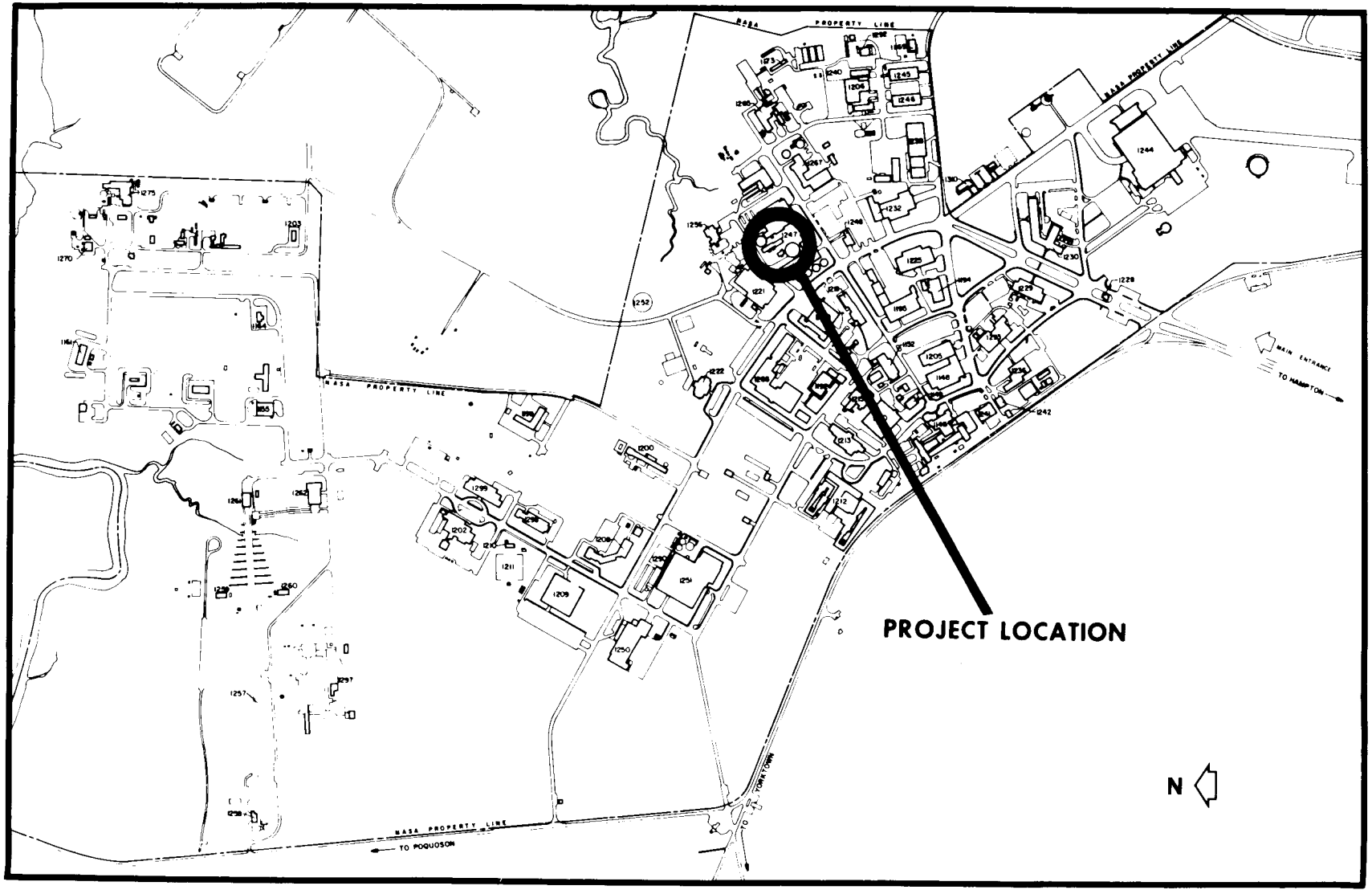


FIGURE 1

PROJECT TTLE: Modifications to Mach 19 Nitrogen Tunnel (1247B)

INSTALLATION: Langley Research Center

FY 1982 CoF ESTIMATE: $1,760,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	21,000	---	21,000
Capitalized investment	N/A	1,500,000	1,500,000
Total	21,000	1,500,000	1,521,000

SUMMARY PURPOSE AND SCOPE:

This project will provide a required unique aerospace testing capability at Langley Research Center (LaRC). These modifications to the Mach 19 Nitrogen Tunnel in the Gas Dynamics Laboratory, Building 1247B (Figure 2), will enable testing over a much wider range of hypersonic conditions than previously attainable. A new interchangeable heater, for use with the existing nozzle, will produce higher temperatures for operation at higher pressures. A new interchangeable nozzle will provide for operation at lower pressures and will be used with the existing heater which will also be rehabilitated by this project (Figure 3). As a result, the Reynolds number range of the facility will be expanded from its present capability of 0.3–0.4 million per foot (1.0–

1.3 million per meter) to an augmented capability of 0.08-0.06 million per foot (0.3-2.0 million per meter). Also, downtime for heater repairs, presently a significant problem, will be greatly reduced. This wider range of test conditions, in combination with the long run time capability of this facility (20 minutes), will significantly enhance hypersonic research. Tests which currently would require more costly and less efficient. overlapping work in numerous facilities will be efficiently done in this one facility at greatly reduced costs. This project will support ground testing for space vehicles such as the Space Shuttle, upgraded versions of the Shuttle, single stage-to-orbit vehicles, heavy lift launch vehicles and planetary atmospheric probes.

PROJECT JUSTIFICATION:

Recent studies have emphasized that research in the hypersonic flight regime is vital for both advanced space transportation vehicles and for planetary probes. In the flight regime of Mach 15-30 at altitudes of 200,000-300,000 feet (60,000-90,000 meters), vehicles experience complex flight conditions caused by high velocities and thick aerodynamic boundary layers resulting from real-gas and viscous-interaction phenomena. In this flight environment, aerodynamic characteristics differ significantly from those observed at lower Mach numbers where the flow may be approximated by a perfect non-viscous gas. Analyses of limited Shuttle orbiter test data at these conditions have shown a need for more thorough assessments of stability, control and performance parameters at high altitude conditions. At high altitudes, transition is made from use of a vehicle's space flight "reaction control system" to use of its lower altitude "aerodynamic control system." In this very high altitude region, the Space Shuttle is the first vehicle to use this blended reaction and aerodynamic control mode extensively. Currently, aerodynamic testing in this flight regime is only marginally covered and includes expensive use of non-NASA facilities, which in some cases have extremely short run times. Test data from these facilities is limited and often questionable. Because of present aerodynamic uncertainties in this flight regime, the Shuttle orbiter carries 1,200 pounds (550 kilograms) of contingency fuel for its reaction control system.

Shuttle flights are expected to identify areas where significant improvements can be made for evolutionary versions of the Shuttle and for future space systems. To achieve these improvements, extensive wind tunnel experiments and analyses are required. Current facilities in both industry and other government agencies can not suitably provide the Mach numbers, Reynolds numbers and run times for the wide range of hypersonic test conditions required.

The modifications provided by this project will substantially reduce the inadequacies of the present Mach 19 Nitrogen Tunnel. As pressures are increased, the temperature must also be increased to prevent nitrogen condensation. The nitrogen supply system can provide pressures up to 16,000 pounds per square inch (11,000 Newtons per square centimeter), but due to the deficient heater, the maximum condensation-free pressure is limited to 5,000 pounds per square inch (3,500 Newtons per square centimeter). In addition to limiting the

maximum operating pressure, the heater requires frequent repairs. Also, the present tunnel nozzle is not usable at pressures below 3,000 pounds per square inch (2,000 Newtons per square centimeter) due to its limited operating range. The new heater and nozzle and the rehabilitation of the existing heater will provide the broad range of test conditions required and greatly reduce downtime for heater repairs.

IMPACT OF DELAY:

Providing this capability now is key to timely research on pressing aerodynamic and flight control questions which are vital to space transportation and the planetary programs. This increased capability is needed to establish the hypersonic high altitude data base required for advanced space transportation system concepts. Limited data is currently derived from various facilities, and in the case of those with short run times, the data is often questionable. Because no one facility can provide the wide range of Reynolds numbers and run times required, validation of flight data must be accomplished by correlating data from these numerous facilities--a very difficult and time consuming task. These modifications will also substantially reduce the cost of research testing to as low as one-third the cost of the many overlapping tests now required.

PROJECT DESCRIPTION:

This project provides the Mach 19 Nitrogen Tunnel with a new interchangeable heater and a new interchangeable nozzle (Figure 3). It also provides for rehabilitation of the existing heater for service at low pressures, and for modification of related systems. The new heater will enable long test runs at stagnation pressures up to 10,000 pounds per square inch (7,000 Newtons per square centimeter) and temperatures up to 3,240°F (1,800°C). The new nozzle, in combination with the rehabilitated heater, will enable tests at pressures down to 1,000 pounds per square inch (700 Newtons per square centimeter). The electrical power supply will be modified to provide for the increased power requirements of the new heater.

The new nozzle will be designed for Mach 19 operation at pressures between 1,000 pounds per square inch (700 Newtons per square centimeter) and 2,000 pounds per square inch (1,400 Newtons per square centimeter) to increase the overall range of test conditions. The subsonic inlet section will be designed to withstand the high temperature, and the minimum and the divergent sections will be made of a high temperature alloy with water cooling.

The existing test section, model support, diffuser, isolation valve, and connection to the vacuum sphere will not be changed. However, connections for electric power and controls, water cooling piping, and inlet gas piping will be modified to suit the configurations of both the new and existing heaters.

PROJECT COST ESTIMATE:

The project cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	
Construction	---	---	---	215,000
Electrical power and control modifications	LS	---	---	155,000
Piping modifications	LS	---	---	60,000
Equipment	---	---	---	1,545,000
Heater	LS	---	---	995,000
Nozzle	LS	---	---	450,000
Existing heater rehabilitation	LS	---	---	100,000
Fallout Shelter (not feasible)	---	---	---	---
Total				1,760,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Schematic Diagram

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project. An ongoing study for improving the productivity of research facilities at LaRC may identify future facility modifications for this wind tunnel.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO MACH 19 NITROGEN TUNNEL (12478)

SITE PLAN

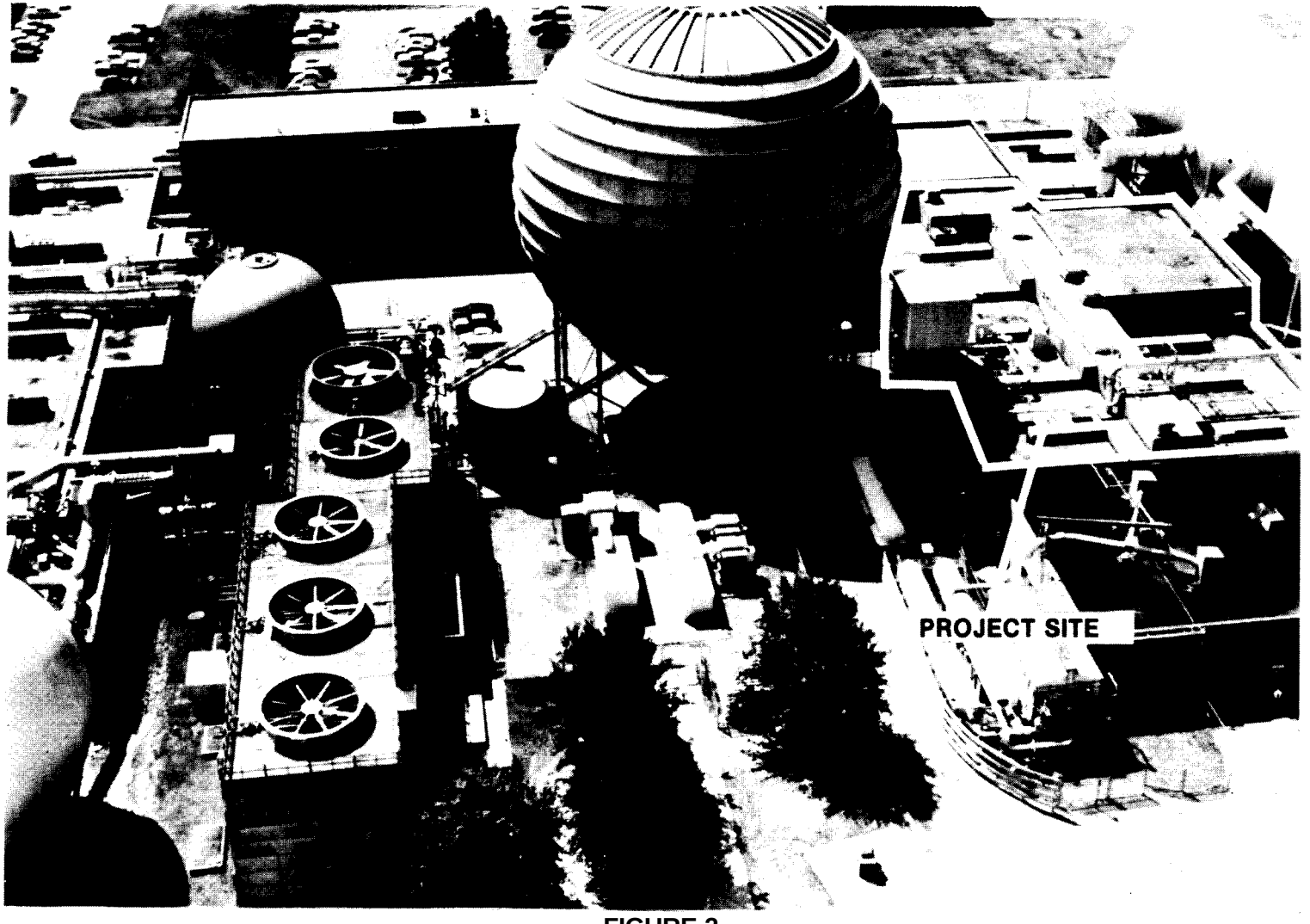


FIGURE 2

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO MACH 19 NITROGEN TUNNEL (12478)

SCHEMATIC DIAGRAM

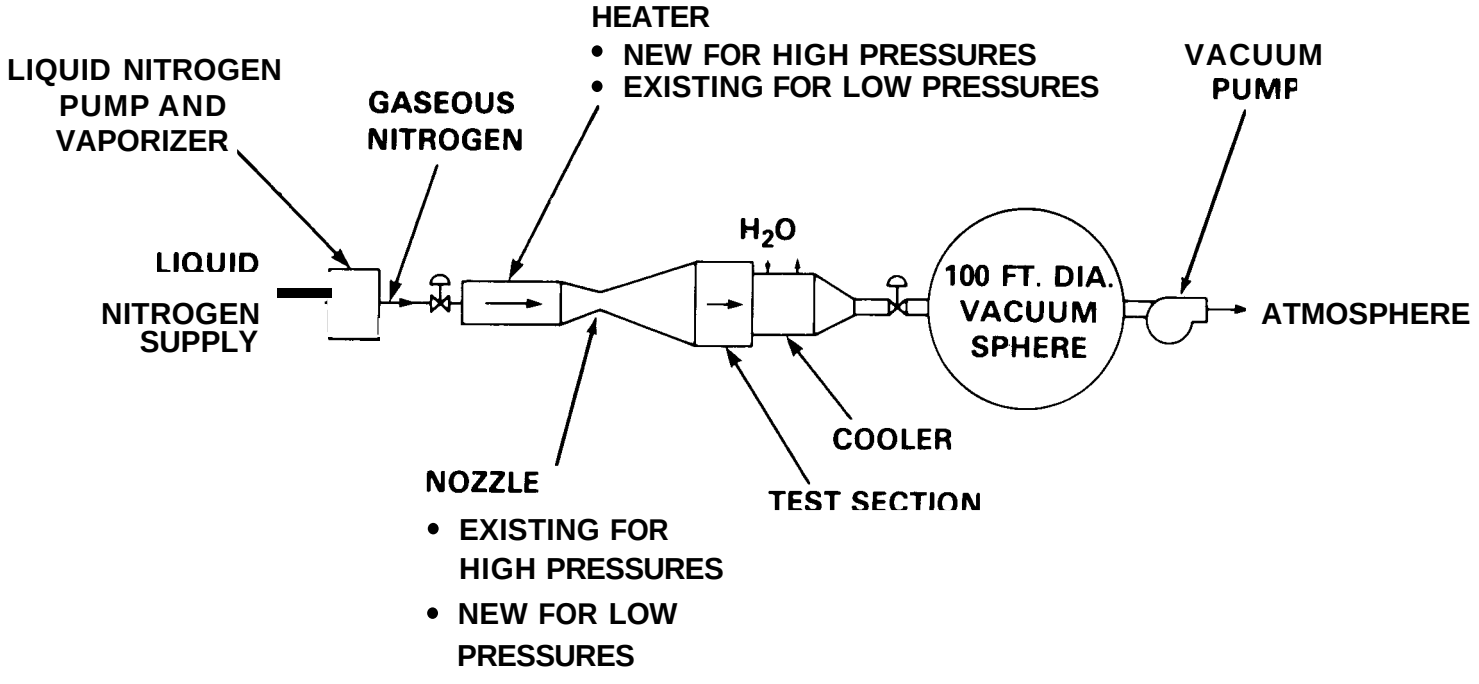


FIGURE 3

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATION OF TRANSONIC DYNAMICS TUNNEL (648)

LOCATION PLAN

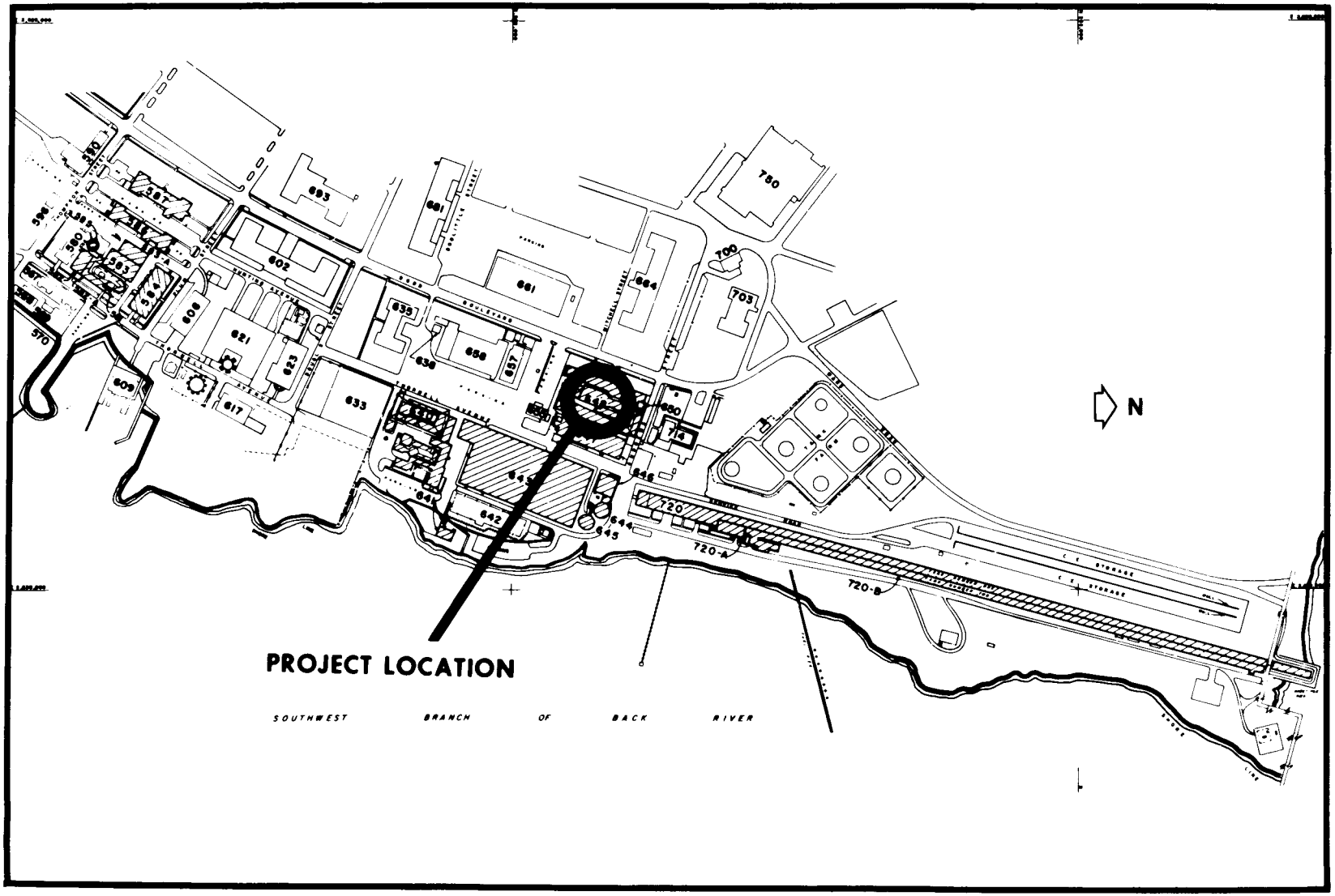


FIGURE 1

CF 6-17

PROJECT TITLE: Modification of Transonic Dynamics Tunnel (648)

INSTALLATION: Langley Research Center

FY 1982 CoF ESTIMATE: $8,000,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	675,200	1,370,000	2,045,200
Capitalized investment	N/A	14,830,305	14,830,305
Total	675,200	16,200,305	16,875,505

SUMMARY PURPOSE AND SCOPE:

The Langley Research Center's (LaRC) Transonic Dynamics Tunnel (TDT) has unique characteristics and features that make it a national resource in the field of aeroelasticity research. It is used for verifying flutter and other aeroelastic characteristics of most U.S. high speed aircraft designs; for research on active flutter controls and rotorcraft aeroelasticity; for flutter, buffet and ground wind loads testing of the Space Shuttle and other launch vehicles; and for confirmation of unsteady transonic flow theory. This project will increase the test medium density range of this tunnel by 50 percent to enable scaling of key aeroelastic parameters for current and anticipated future aircraft designs. This will be achieved by increasing the power of the drive

motor by 50 percent, increasing the tunnel circuit cooling, upgrading the electrical power and control systems and modifying the tunnel fan.

PROJECT JUSTIFICATION:

The TDT's special features include transonic, continuous, variable-density flow; its large 16-foot x 16-foot (5 meter x 5 meter) test section; its flexibility to use either dense Freon-I2 gas or air as a test medium; cable-type model mounting systems; a flutter stopping system; safety screens to protect the tunnel drive system; and, good visibility of models during tests. This tunnel supports various research programs including Supersonic Cruise Research (SCR), Drones for Aerodynamics and Structural Testing (DAST), and Rotor Systems Research Aircraft (RSRA). It will also support testing of new designs incorporating Aircraft Energy Efficiency (ACEE) program technology. Test work currently scheduled for this tunnel includes the F-16, YF-17, F-18, B-1, 747 (with winglets), and L-1011 aircraft.

Aeroelastically-scaled models tested in this tunnel must simulate external shapes, stiffness, stiffness distribution, and mass-density ratio. This ratio of the distributed mass of the vehicle to the mass of the surrounding test medium must be the same for the model as it is for the actual vehicle when in flight. Scaling of the mass-density ratio has been marginal for models of some recent designs. It is expected to be impossible for future models with active flutter controls and/or with major components made of lightweight composite structure materials unless the test medium density capability is increased. This project will provide for a density increase of 50 percent in the Mach number range of 0.6 to 1.2 when using Freon 12 as the test medium. In addition to making it possible to construct aeroelastically-scaled models for future aircraft designs, the increased density capability will improve the flow simulation for models with control surfaces and flaps. It will also lower the present high costs of aeroelastic models and will permit the timely testing of aircraft designs incorporating ACEE program technology.

IMPACT OF DELAY:

This modification project needs to be accomplished now to preclude the necessity of aeroelastic flight testing of current and advanced design aircraft anticipated to reach flutter-test status in the mid-1980's. These aircraft will be designed with features such as active flutter controls and major components made of lightweight composite structure materials. Flight testing is more hazardous, more time consuming, and more costly than wind tunnel testing.

PROJECT DESCRIPTION:

This project provides for in-place rewinding of the 20,000-horsepower (1,500 kilowatt) two-speed electric drive motor (Figure 3) to achieve a fan drive of approximately 30,000 horsepower (2,200 kilowatt). Additional tunnel circuit cooling will be provided to accommodate the increased tunnel drive power by installing a cooling coil adjacent to the existing tunnel cooling coil. A third 5,000-gallon per minute (19,000 liter per minute) cell will be added to the two-cell cooling tower previously provided with FY 1980 resources to provide the additional cooling water required. The 6,600 volt power supply will be modified by installing new circuit breakers and new power cables to the rewound drive motor. The tunnel controls will be updated to provide for smooth, stepless speed control of the repowered drive system. The existing liquid rheostat will be replaced and the additional cooling water required by the larger rheostat will be provided by the third cooling tower cell. All fan blades and blade holders will be replaced with new units designed for the increased tunnel power.

PROJECT COST ESTIMATE:

This project cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	---
Equipment	---	---	---	8,000,000
Rewind drive motor	LS	---	---	1,690,000
Additional cooling and cooling tower	LS	---	---	1,930,000
Power supply modification	LS	---	---	470,000
Controls	LS	---	---	635,000
New liquid rheostat	LS	---	---	755,000
Fan modification	---	---	---	2,520,000
New fan blades	LS	---	---	(880,000)
New fan blade holders	LS	---	---	(1,640,000)
Fallout Shelter (not feasible)	---	---	---	---
Total				8,000,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Main Drive Motor

OTHER EQUIPMENT SUMMARY:

Data acquisition equipment upgrading/replacement is planned for a future R&D budget.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project. An ongoing study for improving productivity of research facilities may identify future facility modifications for this wind tunnel.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATION OF TRANSONIC DYNAMICS TUNNEL (648)

SITE PLAN

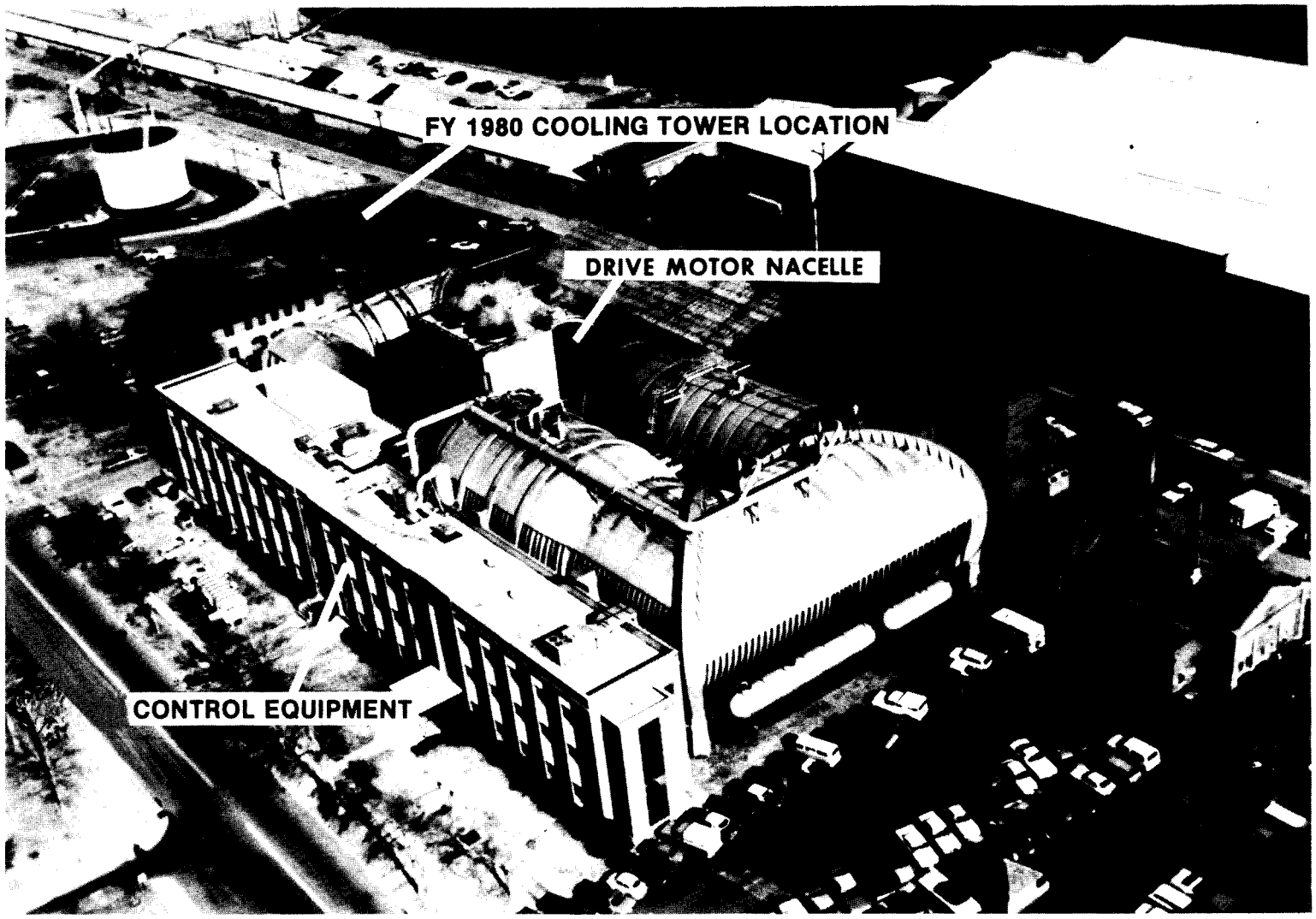


FIGURE 2

LANGLEY RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATION OF TRANSONIC DYNAMICS TUNNEL (648)

MAIN DRIVE MOTOR

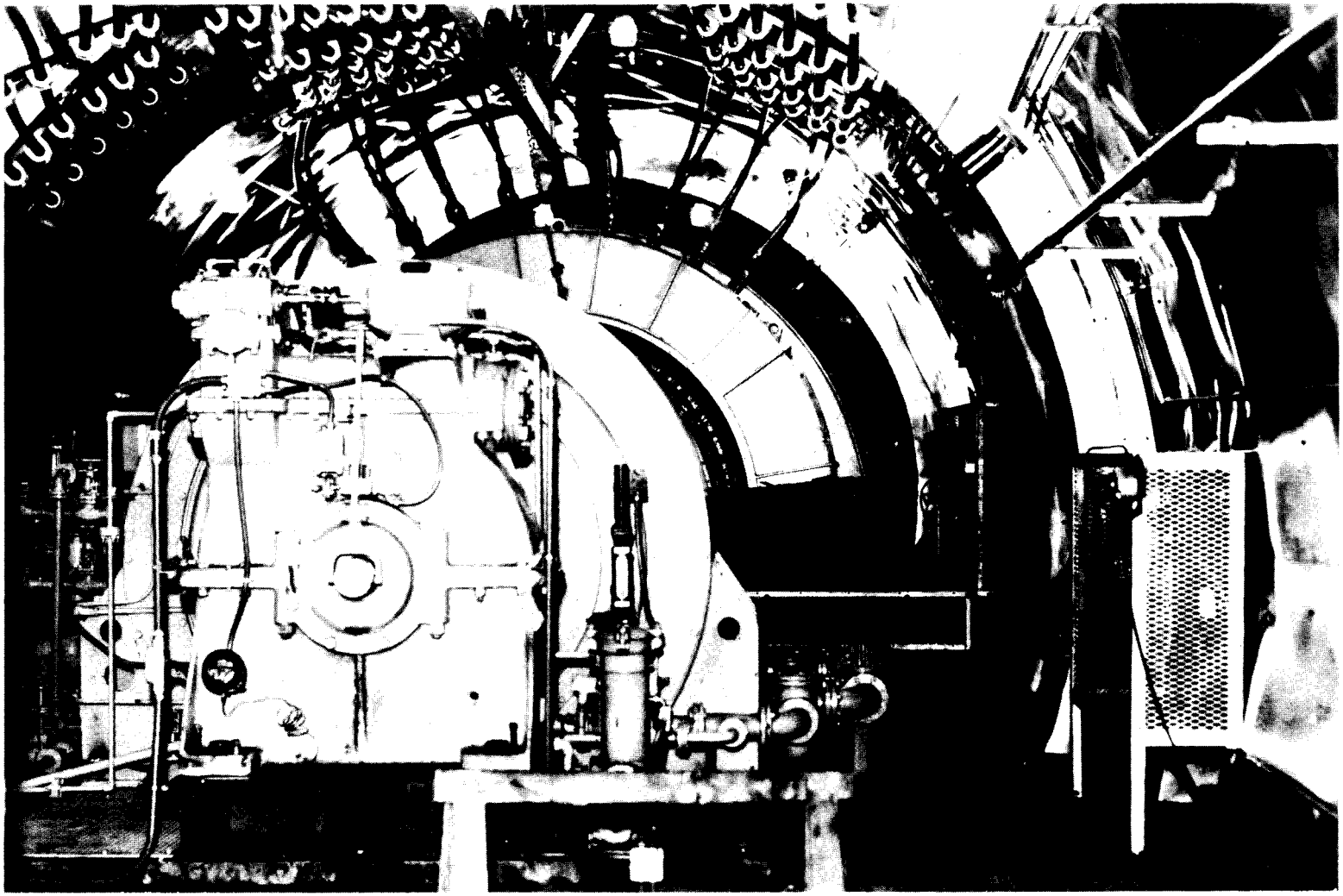


FIGURE 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

LEWIS RESEARCH CENTER

	Amount	Page No.
Office of the Comptroller:		
Decommissioning of Plum Brook Station Reactor Facility, Phase II.....	1,100,000	CF 7-1
Office of Aeronautics and Space Technology:		
Modifications for High Pressure Turbine Corrosion and Thermal Fatigue Testing.....	1,200,000	C 7-10
Modifications for Small Engine Component Testing (5 and 23).....	9,900,000	CF 7-18
Total.....	12,200,000	

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
DECOMMISSIONING OF PLUM BROOK STATION REACTOR FACILITY

LOCATION PLAN

PROJECT LOCATION

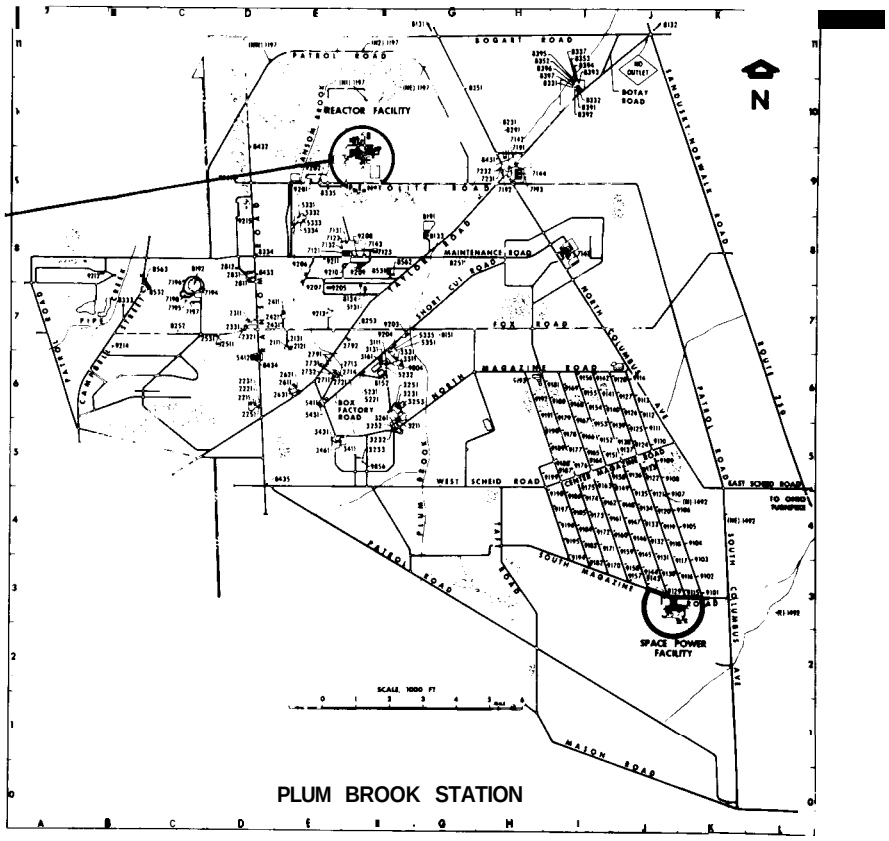


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Decommissioning of Plum Brook Station Reactor Facility, Phase II

INSTALLATION: Lewis Research, Center

FY 1982 CoF ESTIMATE: $1,100,000

LOCATION OF PROJECT: Plum Brook Station, Sandusky, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	---	1,000,000	1,000,000
Capitalized investment	N/A	18,591,000	18,591,000
Total	---	19,591,000	19,591,000

SUMMARY PURPOSE AND SCOPE:

This project is the second increment of five phases of work estimated to cost approximately $17.5 million for decommissioning and dismantling the Lewis Research Center's (LeRC) Plum Brook Station Reactor Facility (Figures 1 and 2). Because of work constraints associated with radiation safety, decommissioning and dismantling of this facility will require approximately five years of effort. The FY 1981 first phase of this work provides for the engineering planning and development of detail work plans and procedures for subsequent phases and the intiation of work activities associated with the removal/decontamination of contaminated and irradiated equipment in Reactor Building 1111 (Figures 3 and 4), and the transport of radioactive material from NASA

property to an approved burial site. The FY 1982 second phase includes continued removal/decontamination of contaminated and irradiated equipment in Building 1111, and transport to an approved burial site. All work will be in strict accordance with Nuclear Regulatory Commission (NRC) requirements and other applicable safety and health standards.

PROJECT JUSTIFICATION:

Research operation of the Reactor Facility was terminated in January 1973 and the facility was subsequently placed in standby status. Because radioactive materials are still present at the site, it is necessary to maintain this facility in a standby status until it can be decommissioned.

This 60 megawatt reactor facility was originally constructed for nuclear irradiation testing of nuclear fueled and unfueled experiments for space applications. Construction was started in 1956 and full power operation was achieved in April 1963. The reactor operated continuously at nearly 60 megawatts until operations were discontinued in 1973. During the period from January 1973 to July 1973, the entire facility was prepared for placement in standby status. At that time all nuclear fuel and fissionable materials were removed. There are no requirements to reactivate the facility and the cost to reactivate in accordance with present day standards would be prohibitive.

Currently, the facility is under three NRC licenses. These include one for possession but not operation of the 60 megawatt test reactor, one for possession but not operation of a small 100 Kilowatt mock-up reactor, and one for possession of radioactive materials. To meet the requirements for these licenses, LeRC must maintain the facility, provide adequate security and general surveillance, provide quarterly radiological monitoring and submit an annual report to NRC. In addition to maintaining the integrity of the buildings, building locks, and fences, LeRC must also maintain electrical power and designated temperature levels in the facility and cathodic protection of the reactor containment vessel. A continuous nitrogen gas purge through the reactor vessel, an alarm system, emergency lights, and telephone service must also be maintained. A communication center that is manned 24 hours per day and an administrative staff are required to fulfill all of the NRC requirements. The cost of maintaining this facility in standby status is approximately $340,000 per year in terms of 1982 dollars. This "holding" activity cost will continue until the radioactive materials and equipment are removed from the facility. A study has shown that other options for decommissioning this facility, all of which involve delayed dismantling, would cost between $41 million and $47 million in terms of 1982 dollars. Early decommissioning and dismantling will avoid these higher long term costs.

IMPACT OF DELAY:

Maintaining this unneeded facility in a standby status is costly and a continuing liability to NASA. Delay in performing this decommissioning work will unnecessarily extend these standby maintenance activities and their costs.

PROJECT DESCRIPTION:

This second phase of the total work for decommissioning and dismantling the 60 megawatt Plum Brook Station Reactor Facility includes continued removal of radioactive material from the containment vessel in Building 1111. This includes removal of contaminated and irradiated equipment from the four experiment quadrants, the dry annular area, and the canal area of the containment vessel. Contaminated equipment will be decontaminated if feasible. Irradiated equipment and contaminated equipment which cannot be decontaminated will be shipped to an approved burial site.

Decontamination of radioactive equipment requires the reactivation of the existing decontamination equipment at the Reactor Facility. This includes the clothing laundry equipment and the equipment for reducing contaminated liquids to radioactive sludge. These reactivation tasks are included in this project.

PROJECT COST ESTIMATE:

This cost estimate is based on an evaluation study and a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	---
Demolition	---	---	---	I ,100,000
Removal/decontamination of radioactive equipment	LS	---	---	530,000
Disposal of radioactive wastes.	LS	---	---	185,000
Support services	LS	---	---	385,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				I, 100,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Aerial Photograph of Reactor Facility
Figure 3 - Site Plan
Figure 4 - Reactor Building (1111) Plan

OTHER EQUIPMENT SUMMARY:

No other equipment is required for this facility.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that an additional $15.4 million will be required to complete the decommissioning and dismantling of this facility over the next three fiscal years.

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
DECOMMISSIONING OF PLUM BROOK STATION REACTOR FACILITY

AERIAL PHOTOGRAPH OF REACTOR FACILITY

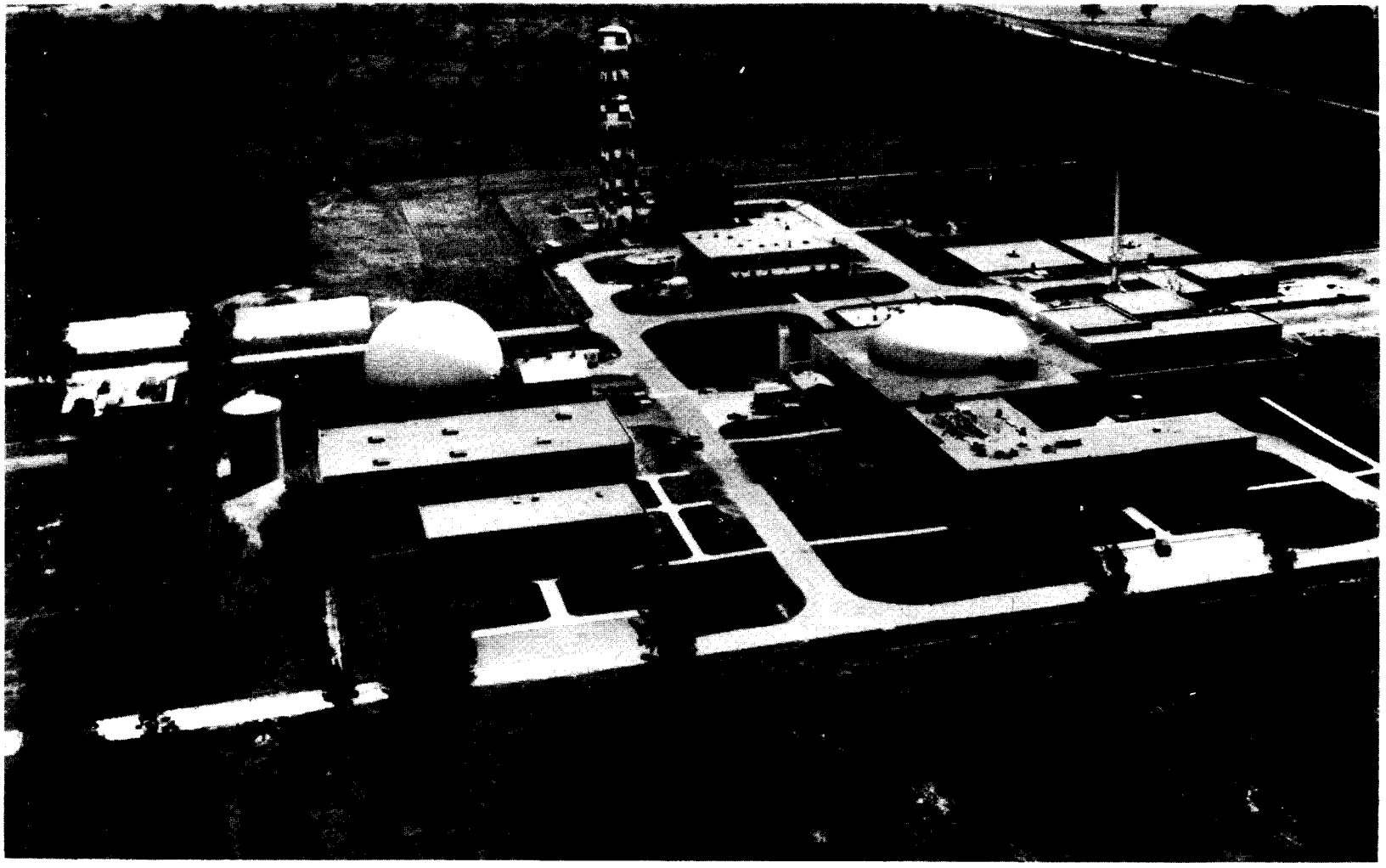


FIGURE 2

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
DECOMMISSIONING OF PLUM BROOK STATION REACTOR FACILITY

SITE **PLAN**

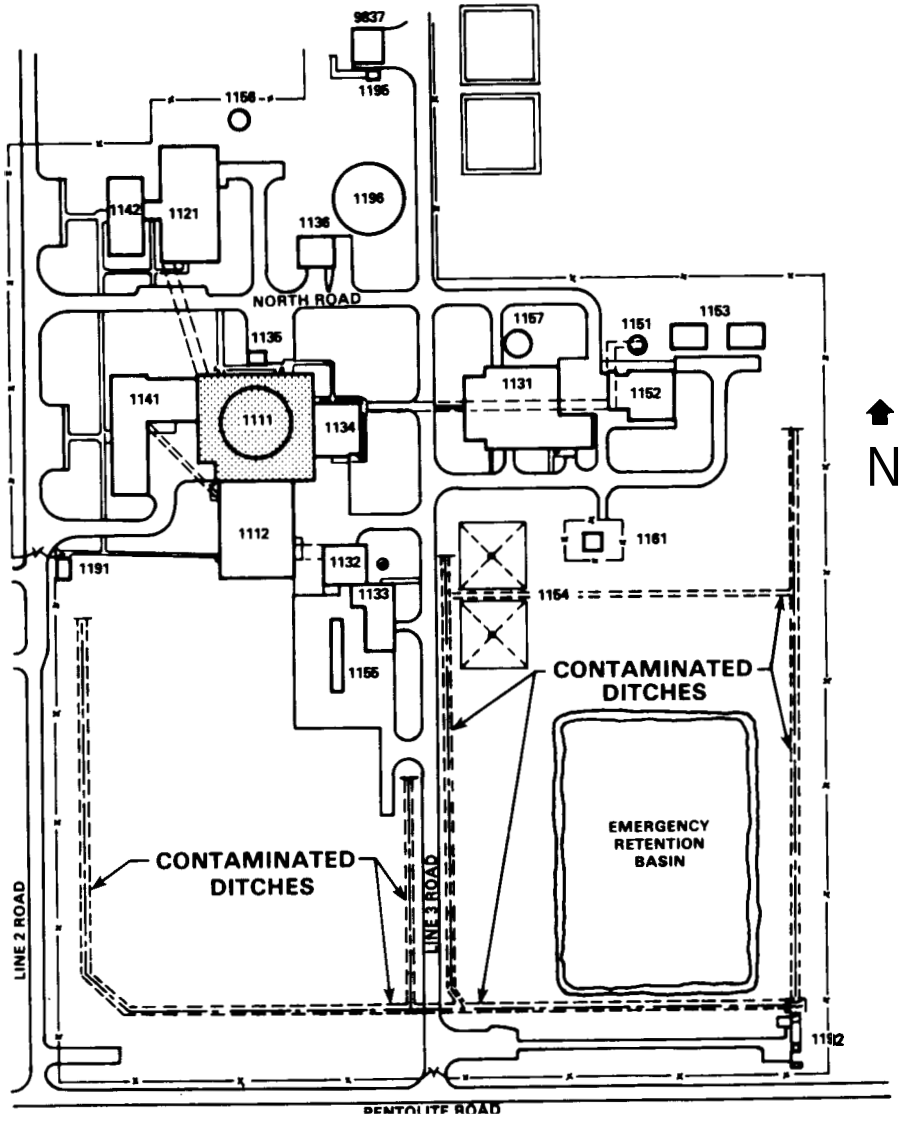


FIGURE 3

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
DECOMMISSIONING OF PLUM BROOK STATION REACTOR FACILITY

REACTOR BUILDING (1111) PLAN

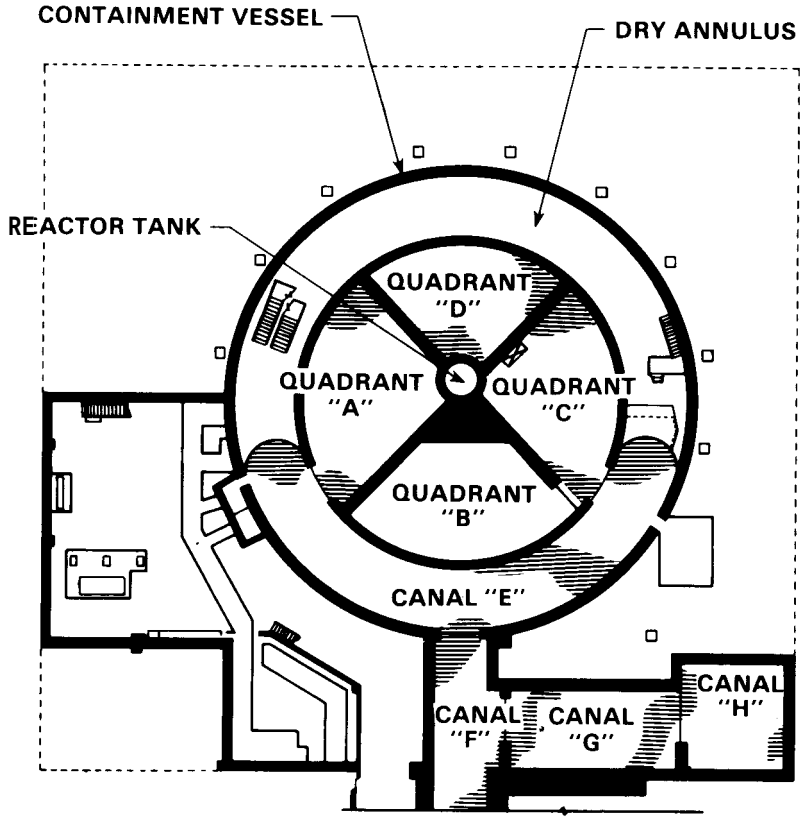


FIGURE 4

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR HIGH PRESSURE TURBINE CORROSION AND THERMAL FATIGUE TESTING

LOCATION PLAN

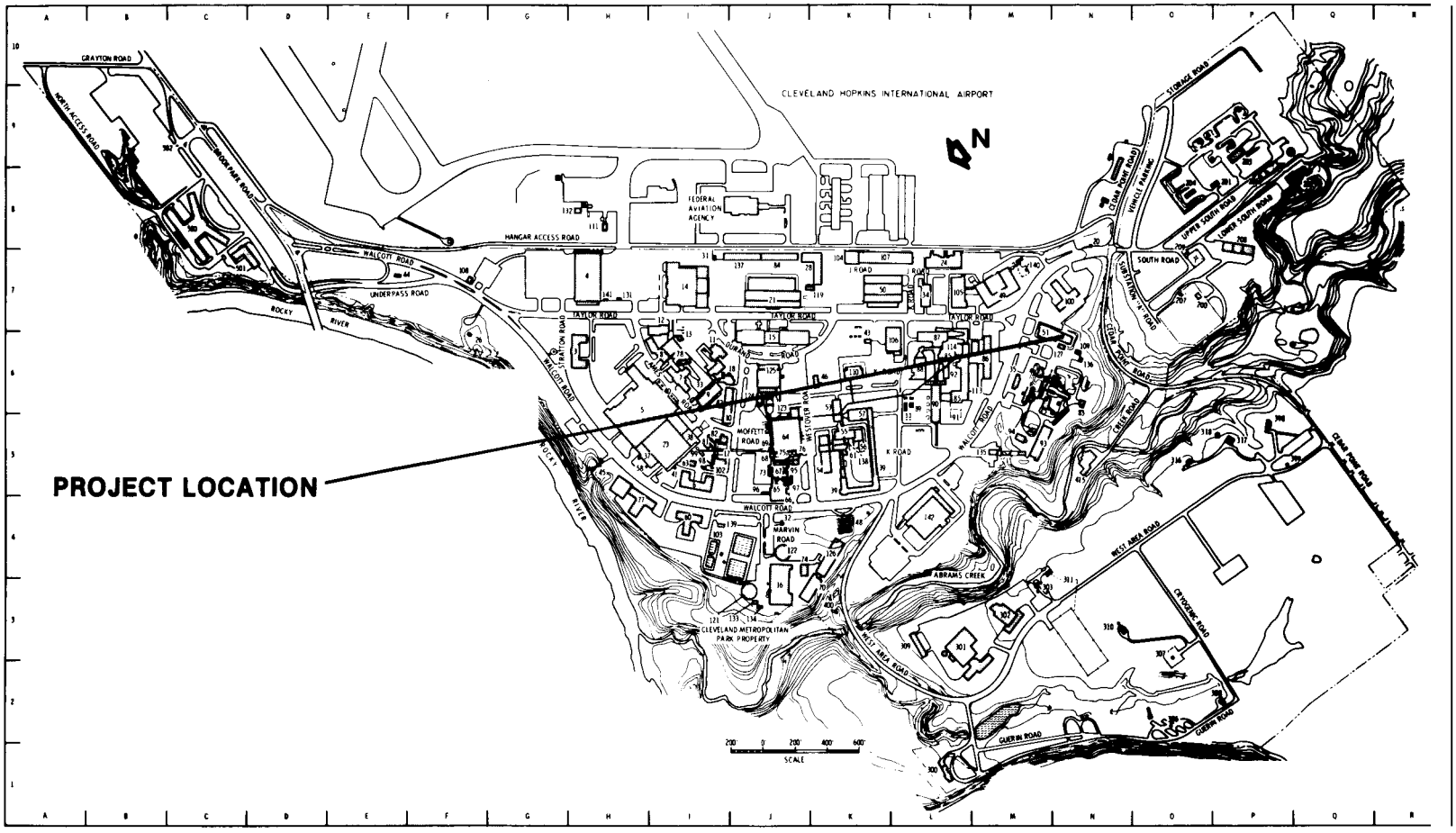


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Modifications for High Pressure Turbine Corrosion and Thermal Fatigue Testing

INSTALLATION: Lewis Research Center

FY 1982 CoF ESTIMATE: $1,200,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	138,000	---	138,000
Capitalized investment	N/A	646,000	646,000
Total	138,000	646,000	784,000

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to Building 51 at the Lewis Research Center (LeRC) for long duration corrosion and thermal fatigue testing of turbine component materials at conditions simulating those encountered in advanced gas turbine engines. Included are site utilities modifications, building modifications to test cell 101 and its test control room (Figures 1 and 2), and the installation of all necessary equipment (Figure 3). Advancements in turbine engines have led to higher operating pressures and temperatures which, although improving engine performance, have greatly contributed to turbine material corrosion and related thermal fatigue

problems. Solutions to these turbine engine materials endurance problems are essential to the development of advanced engines suitable for high performance commercial and military applications.

PROJECT JUSTIFICATION:

Continued improvement of gas turbine engines for aircraft and ground power use is an important part of this Nation's overall effort in energy conservation and environmental protection. Pursuit of higher efficiencies, higher performance, and lower exhaust emissions as part of the Aircraft Energy Efficiency program has led to the development of engines with higher pressure ratios. Some of these engines now operate at internal pressures that approach 600 pounds per square inch (414 Newtons per square centimeter). Future engines are expected to operate at pressures up to 750 pounds per square inch (517 Newtons per square centimeter). Engine life is severely limited by greatly accelerated corrosion and related thermal fatigue problems at such high pressures and corresponding high turbine temperatures. To achieve acceptable life expectancies for these advanced engines, new turbine materials must be developed and tested. This project provides a means for continuous, long duration testing of such materials in environments simulating those of present and future advanced engines.

Corrosion and thermal fatigue characteristics of turbine component materials are known to be pressure sensitive. Ongoing corrosion and thermal fatigue testing is conducted at atmospheric pressure and provides useful materials data for low pressure ratio engine materials research. However, the extrapolation of such data to the higher pressures of advanced engines has provided generally inaccurate results. Therefore, testing must be accomplished at actual operating conditions.

This project provides a cost effective means for accurately conducting the necessary research. The site modifications, building modifications, and equipment installation will provide for materials testing in a corrosive air stream at pressures up to 750 pounds per square inch (517 Newtons per square meter), temperatures to 3,000°F (1,649°C), and speeds to Mach 1 (Figure 3). Flow streamcharacteristics will be preciselycontrollable to establish required test conditions. The control and instrumentation systems will be designed for continuous unattended operation of the test equipment for hundreds of hours. The only alternative to this project is testing of materials in actual engines, a far more complicated and costly option. Additionally, the control and monitoring required for precise research cannot be achieved in actual operating engine tests.

IMPACT OF DELAY:

This project must be implemented now to support the development of efficient high performance advanced engines with economic life expectancies. These new engines are expected to produce significant energy savings and reduce atmospheric pollution. Corrosion and thermal .fatigueare major life-limiting factors in these engines

which makes materials development critical. Since no other facilities exist for accomplishing this necessary research, the unique capability provided by this project is essential.

PROJECT DESCRIPTION:

This project provides modifications to the site electrical utilities and to Building 51 (Figures 1 and 2) for high pressure corrosion and thermal fatigue testing of turbine engine materials. The site electrical utilities work includes the installation of a new 2,400 volt supply line from Substation G (Facility 43) to Building 51 and also installation of a 2,400 volt/480 volt transformer and supporting concrete foundation adjacent to Building 51. Modifications to Building 51 include architectural, electrical, and mechanical work in Test Cell Room 101 and in the associated Test Control Room to accommodate the new equipment being installed. The test cell work includes the installation of a foundation for the new boost compressor: ventilation equipment; a fire suppression system; 2,400 volt, 480 volt, and 120 volt electric power; and repair and painting of damaged building surfaces. The Control Room work includes the installation of 480 volt and 120 volt power and new lighting.

The testing equipment to be installed (Figure 3) includes all mechanical and electrical systems required for conducting the necessary corrosion and thermal fatigue research. A boost compressor will raise the pressure of the 125 pounds per square inch (86 Newtons per square centimeter) service air supplied by the air system to 750 pounds per square inch (517 Newtons per square centimeter). A combustor to burn the selected gas turbine engine fuel will heat the air to required test temperatures up to 3,000°F (1,649°C) and add the products of combustion. Specific salts will be injected into the hot air stream before it impinges on test specimens in the test section. Various support mechanical systems include a fuel system, a salt injection system, a spray cooler system for cooling the test section exhaust gases, and the necessary flow, pressure, and noise controlling equipment for the corrosive air stream. Electrical systems include the instrumentation, controls, and control room equipment for enabling precisely controlled and safe, long-term, unattended testing.

PROJECT COST ESTIMATE:

The project cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	345,000
Site development and utilities	---	---	---	255,000
Electrical utility modifications	LS	---	---	(217,000)
Transformer foundation installation	LS	---	---	(38,000)
Building 51 modifications	LS	---	---	go,000
Equipment	---	---	---	855,000
Boost compressor	LS	---	---	210,000
Combustor	LS	---	---	130,000
Test section	LS	---	---	120,000
Mechanical systems	LS	---	---	100,000
Electrical systems	LS	---	---	295,000
Fallout Shelter (not feasible)	---	---	---	---
Total				1,200,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Schematic Drawing

OTHER EQUIPMENT SUMMARY:

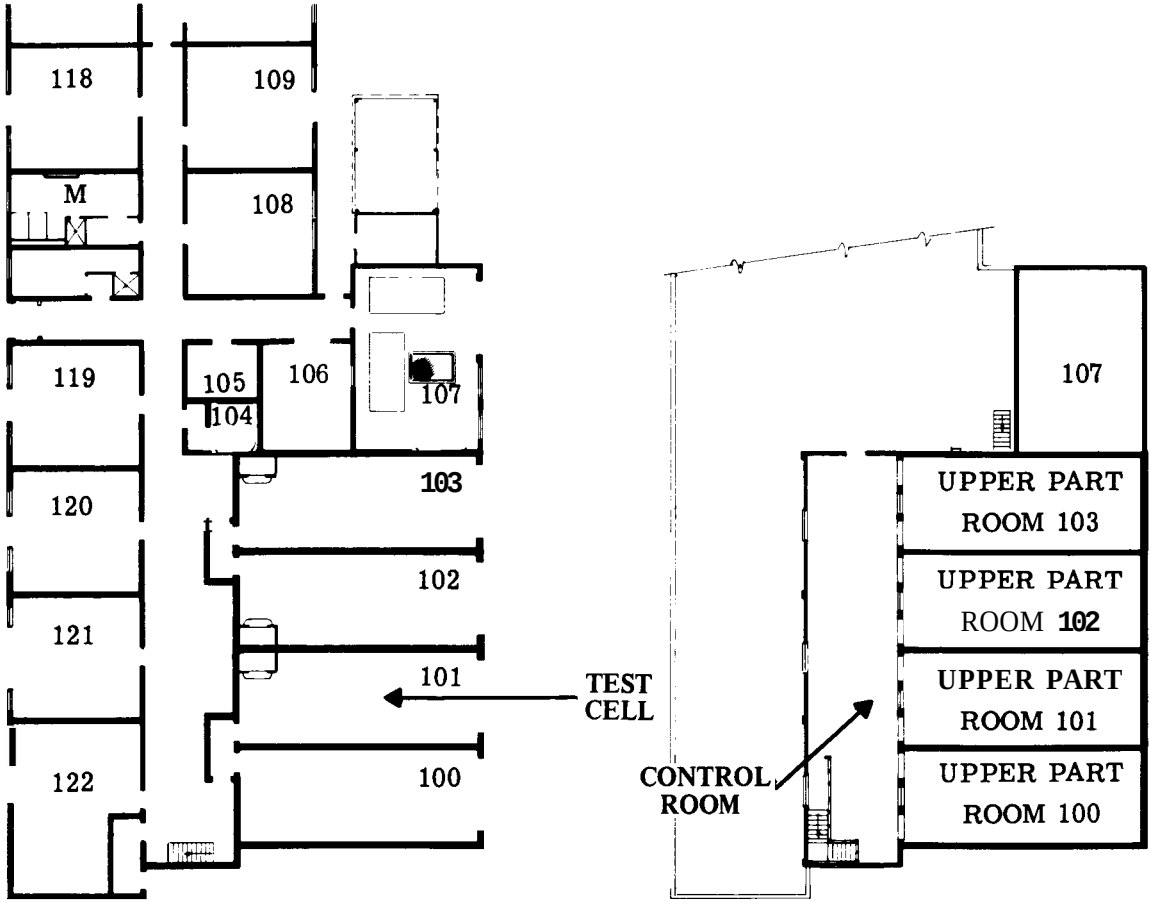
No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No **future CoF funding is required to complete this project.**

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR HIGH PRESSURE TURBINE CORROSION AND THERMAL FATIGUE TESTING

SITE PLAN



FIRST FLOOR PLAN

SECOND FLOOR & ROOF PLAN

HIGH ENERGY FUELS LABORATORY, BUILDING 51
FIGURE 2

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR HIGH PRESSURE TURBINE CORROSION AND THERMAL FATIGUE TESTING

SCHEMATIC DRAWING

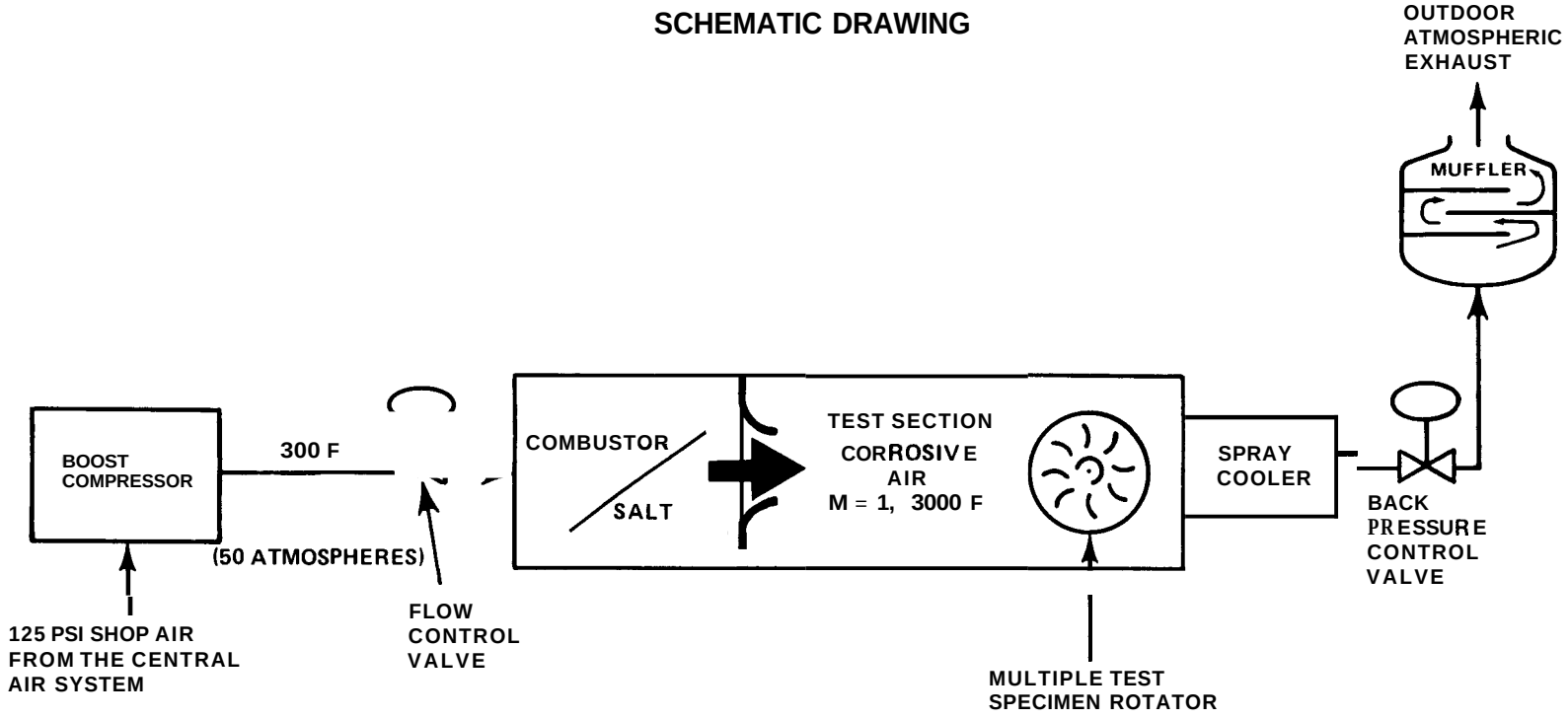


FIGURE 3

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING (5 AND 23)

LOCATION PLAN

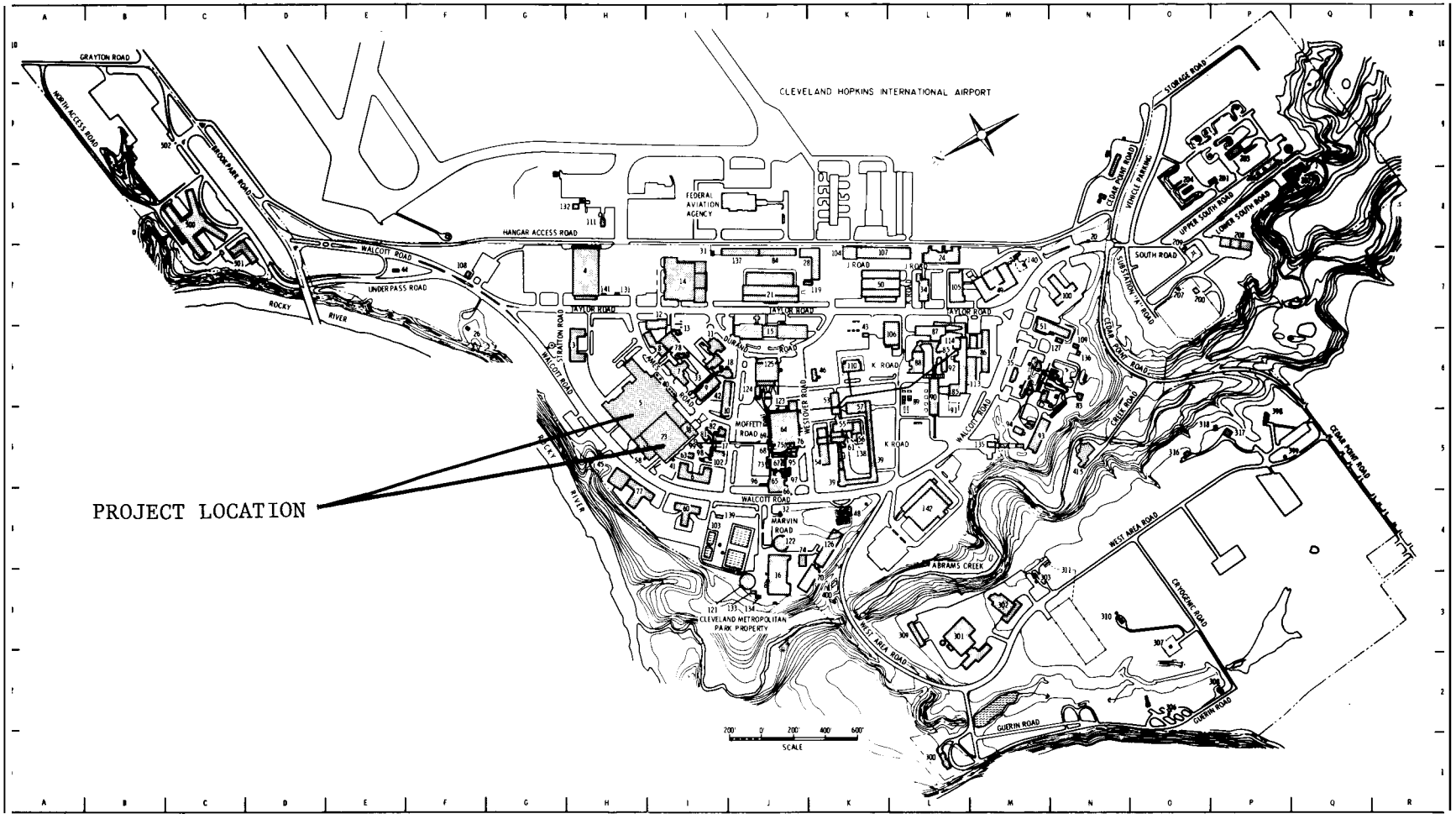


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Modifications for Small Engine Component Testing (5 and 23)

INSTALLATION: Lewis Research Center

FY 1982 CoF ESTIMATE: $9,900,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	937,000	---	937,000
Capitalized investment	N/A	16,814,000	16,814,000
Total	937,000	16.814.000	17,751,000

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to Buildings 5 and 23 of the Engine Research Building complex at the Lewis Research Center (LeRC) for research testing of small gas turbine engine combustors and compressors. Test cell CE-5A in Building 5 will be modified for small engine combustor testing. A 700-square foot (65 square meter) mezzanine test control room will be added to the existing single level test control room located within the high bay area of CE-5A. Equipment for testing combustors at simulated engine operating conditions will also be installed. Test cell W-7 in Building 23 will be modified for small engine compressor testing. Adjacent rooms will be modified for control room use. Equipment required for testing small engine compressors at

simulated engine operating conditions will also be installed. In order to provide the total capability to conduct research programs to develop the comprehensive technology data base needed for improving small engines, a project for providing the turbine testing capability is being considered for FY 1983.

The expanding role of small gas turbine engines makes efficiency improvements increasingly more important. These engines, which typically have up to 5,000 pounds (22,400 Newtons) thrust or 2,000 shaft horsepower (1,492 kilowatts), are used in rotorcraft, small fixed-wing general aviation aircraft, cruise missiles, military tanks, trucks and buses, and for other ground power applications. They are inherently inefficient because of geometric considerations such as compressor and turbine blade clearances. The test capabilities provided by this project will support the development of advanced, higher efficiency small gas turbine engines.

PROJECT JUSTIFICATION:

Small gas turbine engines are being used for an increasing variety of vehicular and stationary applications. Because of difficult geometric problems such as compressor and turbine blade clearances, surface finishes, and leading and trailing edge thicknesses in these small engines, their performance and efficiency has been substantially lower than that of larger engines. Planned research efforts are directed to solving these problems and also to the reduction of exhaust pollutants. Such improvements can be significant contributors to this Nation's energy conservation and environmental protection efforts.

The direction for increasing the performance and efficiency of gas turbine engines is toward higher internal operating pressures and temperatures. Established goals include the eventual development of advanced small engines having 50 to 1 pressure ratio compressors. These goals also include improvements in combustor efficiency, reductions in exhaust pollutants, and development of alternate fuel capabilities. Scaling of large compressor research data to small compressor sizes is inaccurate and misleading because of differences in blade clearances, surface finishes, and edge thicknesses. These inadequacies require research on actual scale components operating at pressures and temperatures corresponding to those of operating engines.

Existing test capabilities of industry and NASA do not provide the full range of test conditions needed to satisfy small engine component research requirements. These requirements include research compressor outlet and inlet pressures of up to 750 pounds per square inch (517 Newtons per square centimeter), temperatures up to 1,250°F. (677°C) and air flows up to 13 pounds per second (5.9 kilograms per second). Existing combustor testing equipment at LeRC is limited to approximately 450 pounds per square inch (310 Newtons per square centimeter), 1,000°F (538°C) and 20 pounds per second (9 kilograms per second). The combustor testing capability provided by this project will furnish the necessary testing capability for small engine combustors and also provide an enhanced capability for testing larger combustors and sectors of large combustors.

The existing compressor testing equipment at LeRC does not provide the full range of operating conditions needed to conduct a comprehensive small engine compressor research program. Very small compressors are tested with equipment capable of 100,000 revolutions per minute and 200 horsepower (149 kilowatts). Larger compressors are tested with equipment capable of 18,000 revolutions per minute and 15,000 horsepower (11,190 kilowatts). This equipment cannot provide the test capability of up to 60,000 revolutions per minute at up to 6,000 horsepower (4,476 kilowatts) required for small engine compressors associated with aircraft and rotorcraft engines.

The new test capabilities provided by this project are essential for the testing requirements of the Propulsion Components portion of the Rotorcraft Configuration/Component Technology Program proposed for FY 1982. In addition to supporting research for improving small engines under this program, these test capabilities will provide needed support to other planned and ongoing small engine combustor and compressor programs and also to general combustor programs. Such programs include the Advanced Low Emission Combustor Program, the Fuels Technology Program, and the Research and Technology base effort in combustion and pollutant emission fundamentals. Combustion research for the Department of Energy for ground power gas turbine engine applications which is primarily directed towards the efficient, clean burning of low quality fuels will also be supported.

Small engine compressor research to be supported includes verification of advanced internal flow analysis codes. This work will include studies of aerodynamic and geometric parameters including blade dimensional proportions, shapes, and loading as well as clearances, fluid friction, and variations in compressor casings. As a result of ongoing research, an advanced research compressor will be made available for testing in this proposed facility by FY 1984.

IMPACT OF DELAY:

This work must be accomplished now to be timely in providing the testing capabilities required for the Propulsion Components portion of the Rotorcraft Configuration/Component Technology Program proposed for FY 1982. Advanced compressors/combustors developed in this program will be available for testing in FY 1984. Ongoing and planned component research work will greatly benefit from the earliest possible availability of the new combustor capability. Funding of this project in FY 1982 will enable completion of modifications during the latter half of 1983 to support testing requirements.

PROJECT DESCRIPTION:

This project provides for modifications to Buildings 5 and 23 of the Engine Research Building complex for full scale testing of small gas turbine engine combustors and compressors at actual engine operating conditions. It includes modifications to Building 5 (Figures 1 and 2) and the installation of the equipment for testing

combustors (Figure 4). Room CE-5A will be modified for use as the test cell. A 700-square foot (65 square meter) mezzanine test control room will be added to an existing single level test control room, CE-5, which is located within the high bay area of test cell CE-5A. The main floor CE-5 test control room will continue to be used for research operations in test cell CE-5B. Foundations will be installed for the boost compressor and the air heater, and floors, walls, ceilings and doors of the test cell will be rehabilitated or modified as required to meet functional requirements and safety standards. Ventilation systems for CE-5A will be installed as well as new heating, ventilating, and air-conditioning (HVAC) equipment for CE-5. Electric power will be provided for the new equipment to be installed in the test cell and the test control room. This new equipment includes a boost compressor and an air heater for providing the required combustor inlet pressure and temperature, air piping to and from three research combustor test positions, fuel systems for the air heater and the research combustors, and a cooling water system for spray cooling the research combustor exhaust gases. Also included are the facility operation, instrumentation and control systems.

The modifications for compressor testing include modifications to Building 23 (Figures 1 and 3) and the installation of the necessary equipment for testing compressors (Figure 5). Test cell W-7 will be modified for this testing and rooms W-209, W-211, and W-221 totaling 650 square feet (60 square meters) will be modified for control room use. The work includes removal of room W-221 walls, installation of a 2-ton (1,816 kilogram) bridge crane in room W-7, and general rehabilitation of building interior surfaces. A new HVAC system will be installed in the test control room. Electric power will be provided for the new equipment to be installed in the test cell and in the test control room. The equipment to be installed for testing compressors includes a two-source inlet air supply piping system. One source will be atmospheric air for simulating turbojet engine compressor inlet conditions. The other source will be compressed air at 40 pounds per square inch (27.6 Newtons per square centimeter) for simulating turbo fan engine compressor inlet conditions. Discharge piping includes a collector vessel to receive air from the research compressor, a back pressure control valve, and a spray cooler to cool the hot compressor discharge gases. A 6,000 horsepower (4,476 kilowatt) electric motor will drive the research compressor through a gear box to attain compressor speeds up to 60,000 revolutions per minute. Also included are the facility operation, instrumentation, and control systems.

PROJECT COST ESTIMATE:

The project cost is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1,110,000
Building 5				
Architectural/structural	LS	---	---	333,000
Mechanical	LS	---	---	169,000
Electrical	LS	---	---	357,000
Building 23				
Architectural/structural	---	---	---	42,000
Mechanical	---	---	---	27,000
Electrical	---	---	---	182,000
Equipment	---	---	---	8,790,000
Building 5				
750 psi boost compressor system..	LS	---	---	2,076,000
Air heater	LS	---	---	1,140,000
Air piping	LS	---	---	1,650,000
Fuel system	LS	---	---	110,000
Cooling water system	LS	---	---	188,000
Instrument and control systems.	LS	---	---	996,000

	Unit of Measure	Quantity	Unit cost	cost
Building 23				
Inlet air piping	LS	---	---	300,000
Discharge air piping	LS	---	---	618,000
Cooling water piping	LS	---	---	10,000
Drive system	LS	---	---	1,142,000
Instrument and control systems.	LS	---	---	560,000
Fallout Shelter (not feasible)	---	---	---	---
Total.				9,900,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan, Combustor Testing Site
Figure 3 - Site Plan, Compressor Testing Site
Figure 4 - Schematic Drawing, Modifications for Combustor Testing in Building 5
Figure 5 - Schematic Drawing, Modifications for Compressor Testing in Building 23

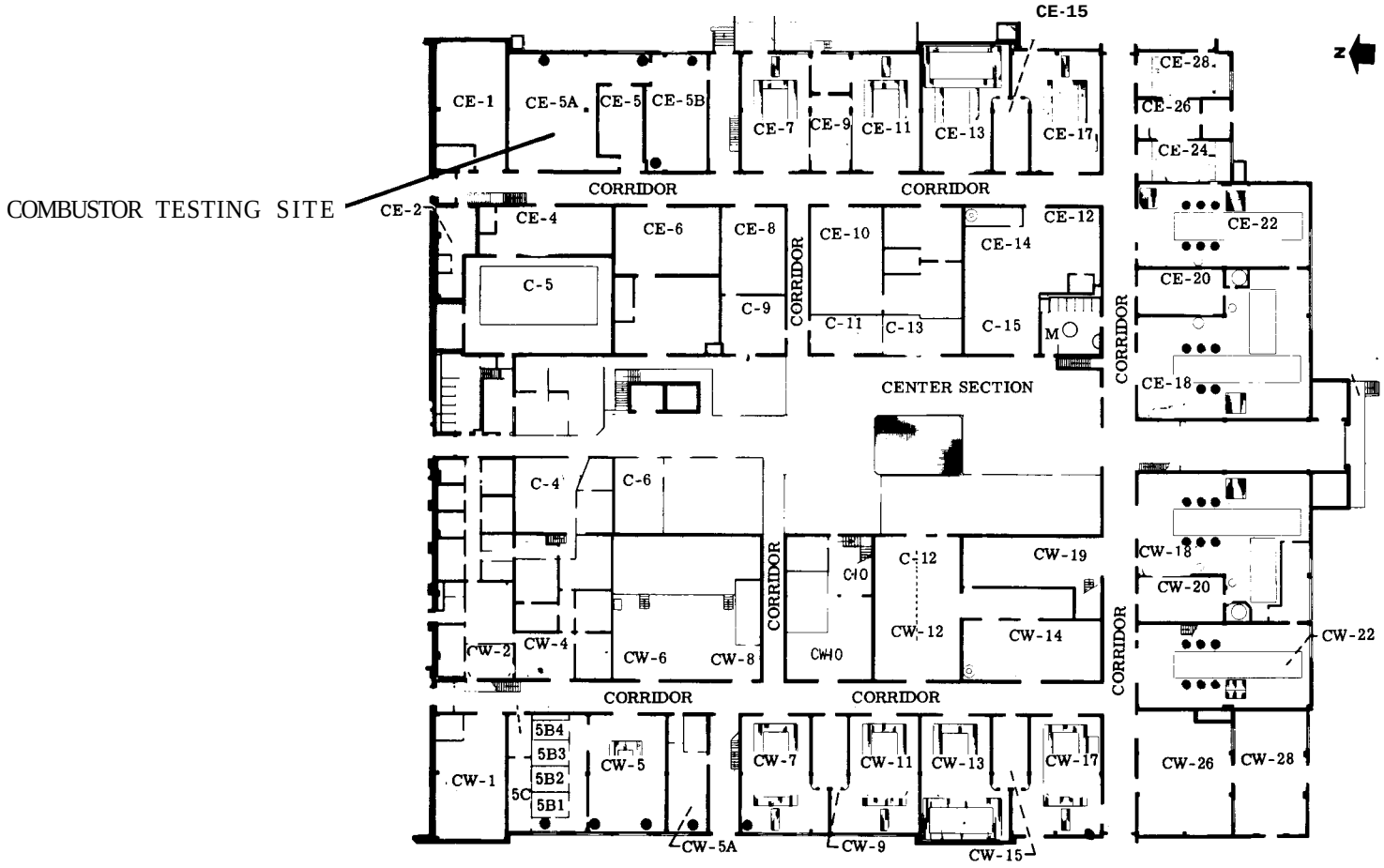
OTHER EQUIPMENT SUMMARY:

Research combustors, compressor and data acquisition system costing approximately $2.8 million are required for initial operation of this facility and will be funded with Research and Development (R&D) resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No additional CoF funds are required to complete this project. However, a follow-on project currently estimated at $9.4 million to provide a small engine turbine testing capability is being considered for FY 1983.

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING (5 AND 23)
SITE PLAN

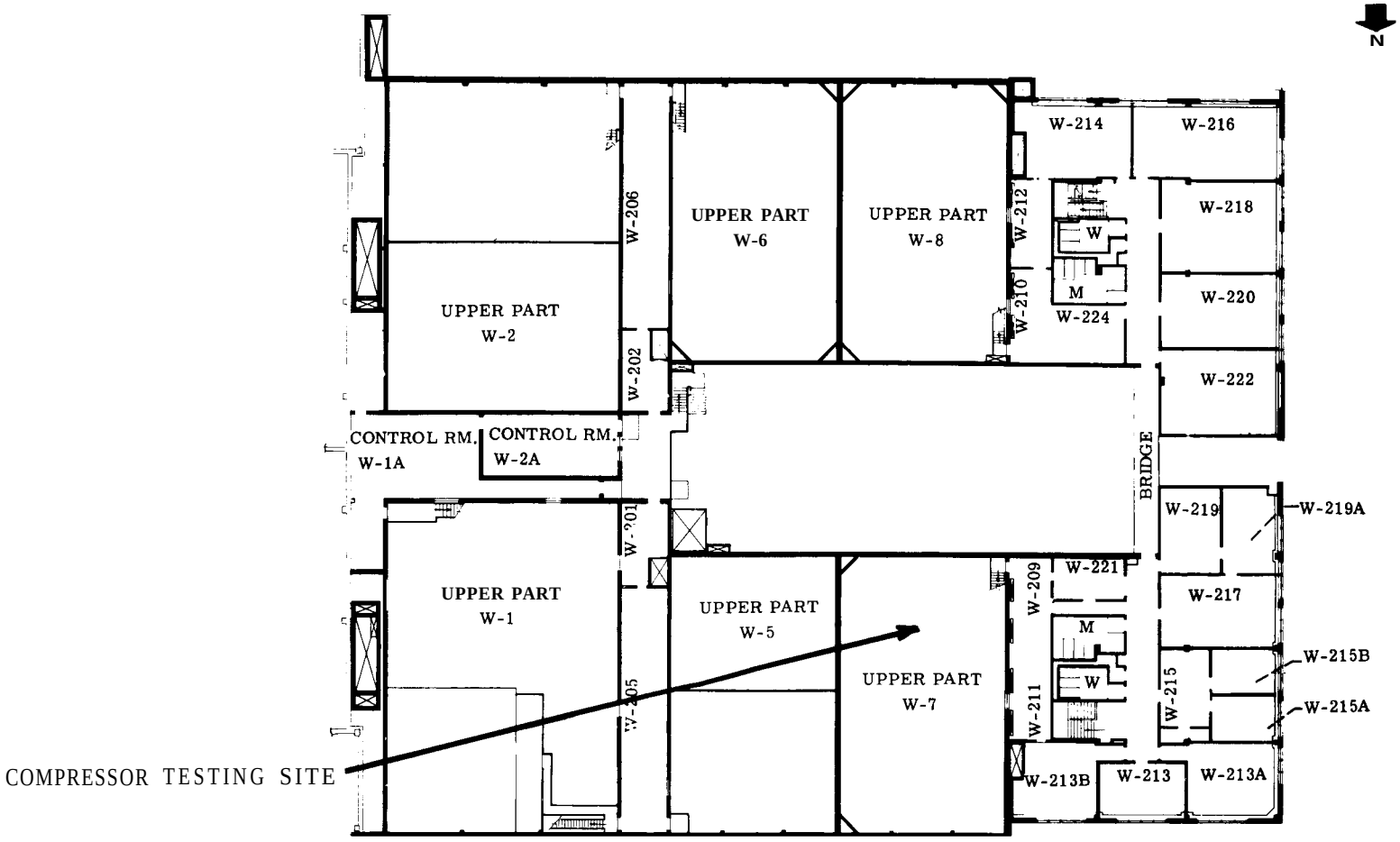


ENGINE RESEARCH BUILDING 5 (CENTRAL SECTION)

FIGURE 2

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING (5 AND 23)

SITE PLAN



WEST WING ENGINE RESEARCH BUILDING NO. **23**

FIGURE 3

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR **SMALL** ENGINE COMPONENT TESTING (5 **AND** 23)

SCHEMATIC DRAWING—MODIFICATIONS FOR COMBUSTOR TESTING IN BUILDING 5

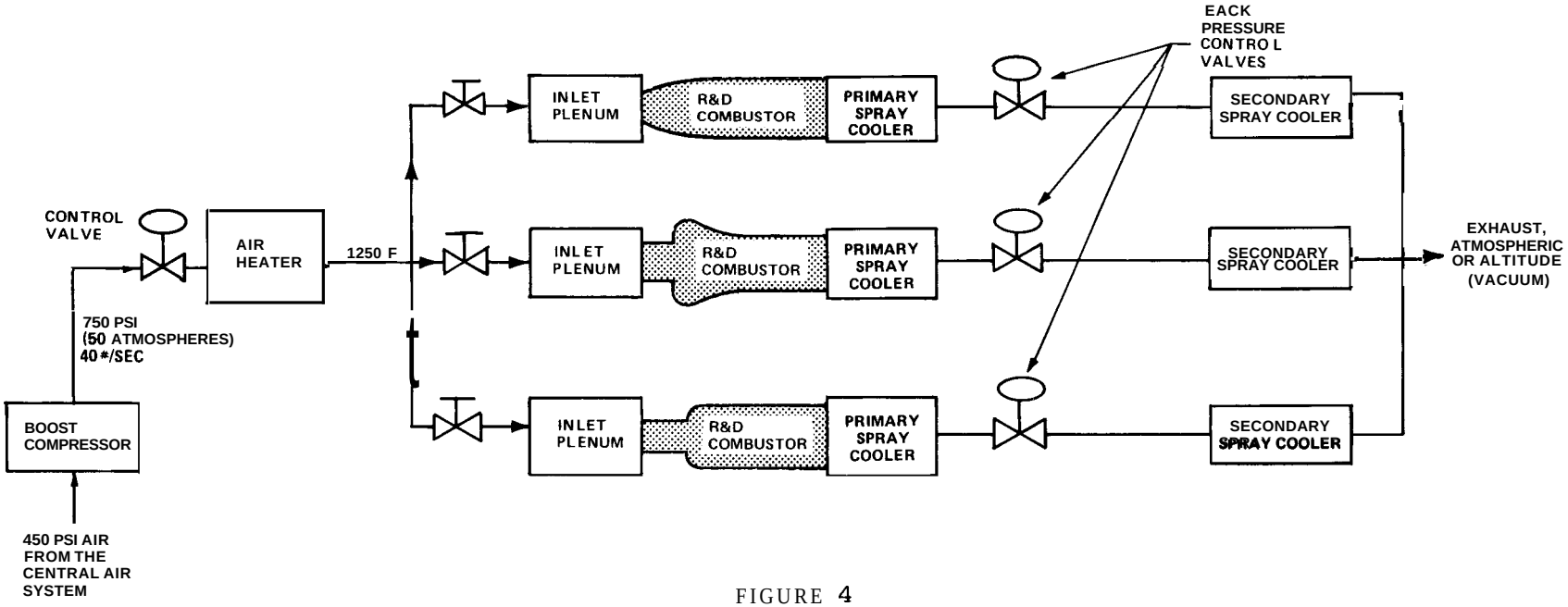


FIGURE 4

LEWIS RESEARCH CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR SMALL ENGINE COMPONENT TESTING (5 AND 23)

SCHEMATIC DRAWING—MODIFICATIONS FOR COMPRESSOR TESTING IN BUILDING 23

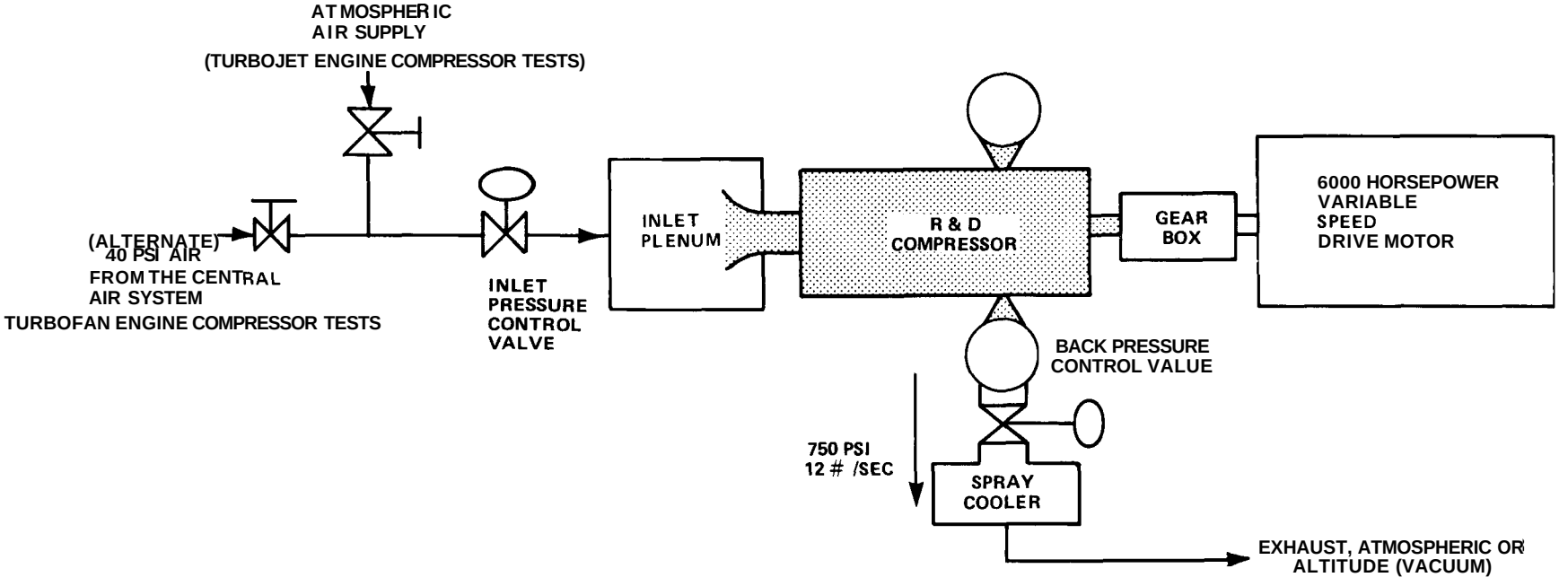


FIGURE: 5

MARSHALL SPACE
FLIGHT CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

GEORGE C. MARSHALL SPACE FLIGHT CENTER

	Amount	Page No.
Office of Space Transportation Systems:		
Modifications for Solar Electric Propulsion Systems Thruster Testing.	1,400,000	CF 8-1

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR SOLAR ELECTRIC PROPULSION SYSTEMS THRUSTER TESTING

LOCATION PLAN

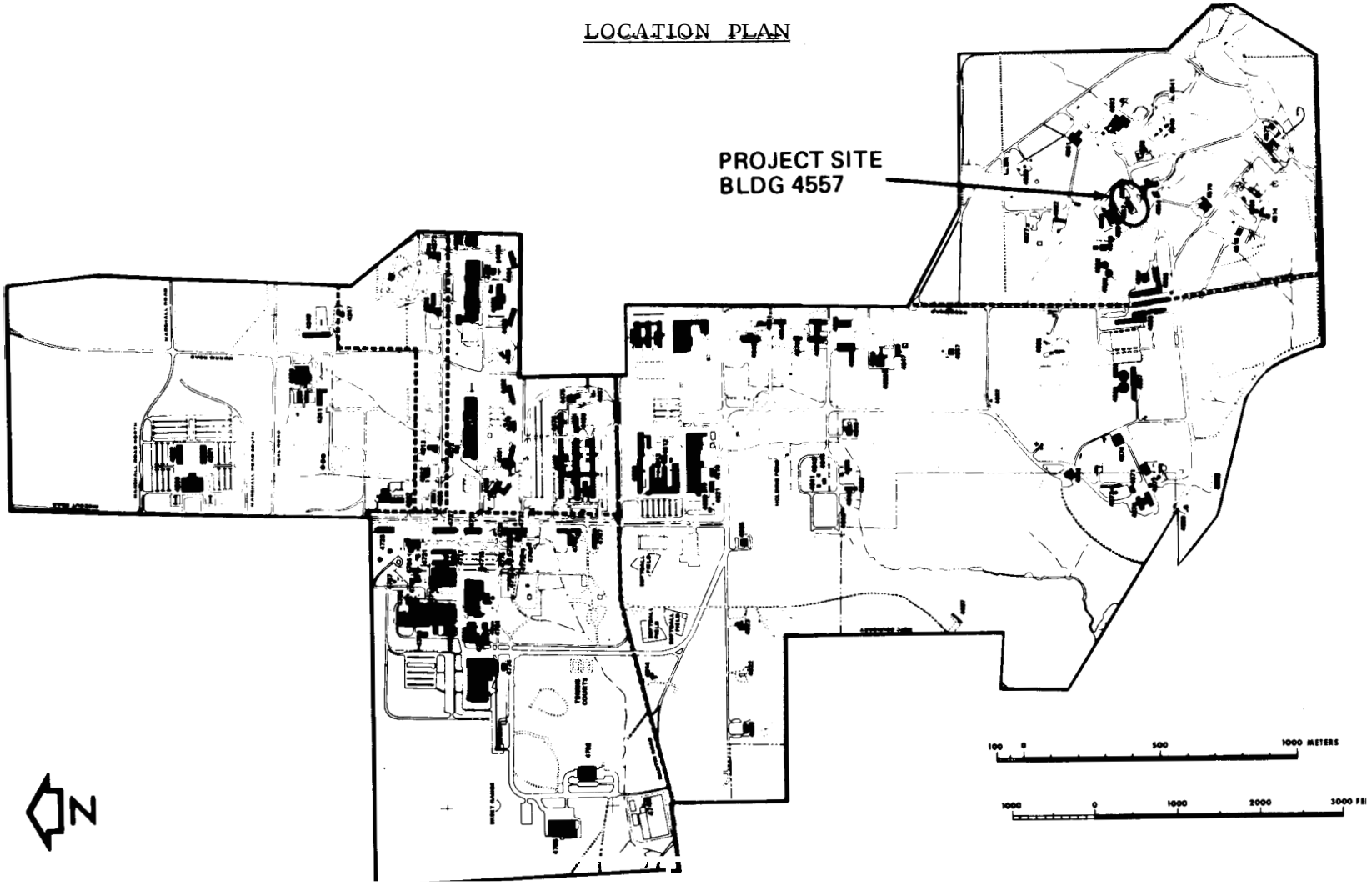


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Modifications for Solar Electric Propulsion Systems Thruster Testing

INSTALLATION: George C. Marshall Space Flight Center

FY 1982 CoF ESTIMATE: $1,400,000

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	146,000	---	146,000
Capitalized investment	N/A	1,032,000	1,032,000
Total	146,000	1,032,000	1,178,000

SUMMARY PURPOSE AND SCOPE:

This project will provide for modifications of the High Vacuum Test Facility, Building 4557 (Figure 1) at Marshall Space Flight Center (MSFC) to provide capability for testing and evaluating propulsion ion thrusters. The vacuum facility will be reactivated from its present standby condition and modified to accommodate ion thruster test and instrumentation equipment. Also included is the installation of an ion thruster target to minimize back-sputter of the mercury exhaust beams. This work will permit testing of up to three thrusters and allow thruster changeout without loss of vacuum. It will allow concurrent thruster evaluation and interactive effects analysis between thrusters and their multi-kilowatt power supplies.

PROJECT JUSTIFICATION:

Future exploration and use of space depends in part upon the development of advanced propulsion capabilities. Existing propulsion technology, which basically utilizes the release of energy stored within chemical propellants, has supported the exploration and utilization of space over the past two decades. This technology will continue as a fundamental element of space capabilities. However, a new propulsion technology must be made available after launch to permit greater exploration and use of space. Solar electric propulsion from ion engine thrusters represents the next step in space propulsion technology. Large, high power, light weight solar arrays and highly efficient ion thrusters and power processors have been developed and testedtodemonstrate the practicability of the Solar Electric Propulsion System (SEPS). SEPS uses the sun's energy to ionize a propellant (mercury in this case) and accelerate the propellant ions to extremely high velocity, thus producing vehicle thrust. SEPS will provide high energy transportation for planetary and geosynchronous payloads in the 1980's and 1990's. A full-scale test facility is required to move into the critical testing phase of this propulsion program.

Long term (15,000 hours) full scale ion thruster testing is essential to broaden the technology base considered necessary for this development program. This full scale testing will evaluate ion thruster performance and enable the development of high-efficiency ion thruster power supplies. Interfaces and compatibility between the thrusters, their power supplies, and control circuitry will be established. Failure and problem investigations during thruster development will later be used for real-time mission support pertaining to roconfiguration, failure analysis, and mission mode simulations.

The existing High Vacuum Test Facility (Building 4557) at MSFC, with it's unique capability for vacuum testing, is ideally suited for this program. Only minor modifications are necessary to provide the desired test capabilities. The refurbishment and modification work included in this project are required to provide a facility capability for timely development of the SEPS ion stage at minimal cost.

IMPACT OF DELAY:

The nature of the electric propulsion system requires that the ion thrusters have a lifetime of approximately 15,000 hours. Evaluation of flight-type designs must therefore begin far in advance of a planned actual mission. With potential mission applications as early as the 1986–87 time frame, it becomes essential that these facility modification proceed in fiscal year 1982 to permit approximately 21 months of continuous testing prior to manufacturing the flight hardware.

PROJECT DESCRIPTION:

This project will provide for modification and refurbishment of the High Vacuum Test Facility, Building 4557 (Figures 2 and 3) to provide capability for developmental testing of the Solar Electric Propulsion System (SEPS) thrusters. Included are modifications to the 15-foot diameter vacuum chamber to convert it to a dedicated multiple thruster solar electric propulsion test position. Air locks will be installed to allow individual removal and installation of thruster assemblies. A thruster exhaust beam target of variable depth and its supporting structure will be added to the chamber. Because of the corrosive effects of mercury on aluminum, the existing aluminum cold wall will be removed and replaced with a stainless steel cold wall. Additional penetrations will be added to the chamber to provide view ports and instrumentation systems. A mercury supply system will be installed for feeding the ion thrusters under vacuum conditions. The existing vacuum system (blowers, mechanical pumps and diffusion pumps) will be refurbished or replaced as required. A detection system, carbon filtration system, and other safety systems will be installed to accommodate the safe handling of mercury.

Other portions of the existing facility will be modified to support the new mission. These building modifications consist of: demolition of existing subsystems that are not required such as the liquid hydrogen (LH_2) system and helium chiller system; installation of insulation and heating and air-conditioning systems; construction of an instrumentation and control room for facility and test article operations, and a work support area.

This project will also provide for the rehabilitation of the existing liquid nitrogen (LN_2) storage and transfer system adjacent to Building 4557 and conversion of the existing liquid oxygen storage area to LN_2 storage.

PROJECT COST ESTIMATE:

The cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1,054,000
Building rehabilitation and modification	LS	---	---	384,000
Vacuum chamber modifications and rehabilitation	LS	---	---	276,000
Control room	LS	---	---	25,000
Air locks	LS	---	---	135,000
Thruster modifications	LS	---	---	234,000
Equipment	---	---	---	346,000
Controls	LS	---	---	232,000
Instrumentation	LS	---	---	114,000
Fallout Shelter (not feasible).	---	---	---	---
Total				1,400,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Perspective (cut-away)

OTHER EQUIPMENT SUMMARY:

Special test equipment and other related instrumentation will be needed to accomplish test operations. These will be funded from **R&D** sources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future **CoF** funding will required to complete this project.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR SOLAR ELECTRIC PROPULSION SYSTEMS THRUSTER TESTING

SITE PLAN

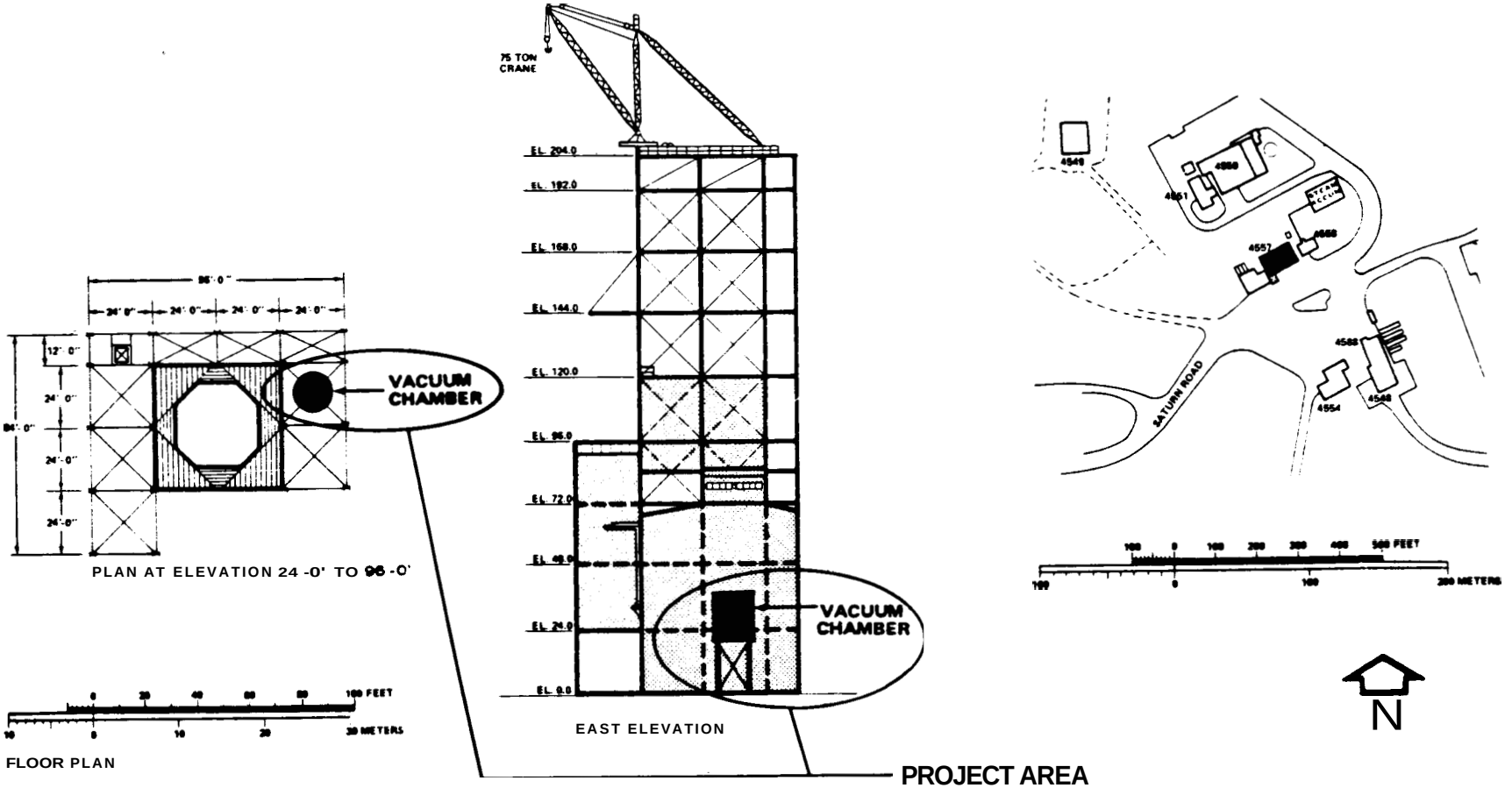
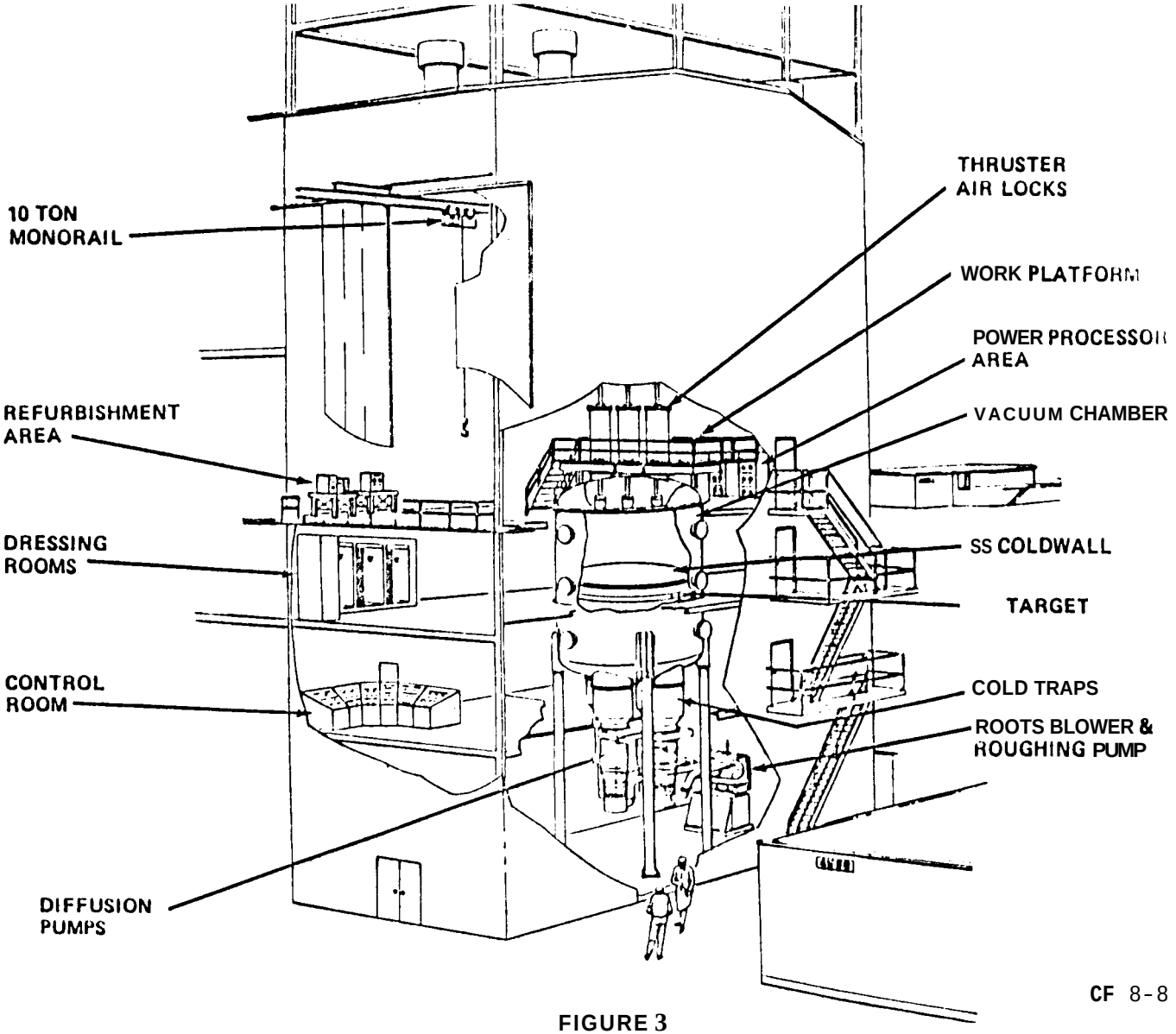


FIGURE 2

CF 8-7

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS FOR SOLAR ELECTRIC PROPULSION SYSTEMS THRUSTER TESTING

PERSPECTIVE



CF 8-8

FIGURE 3

VARIOUS
LOCATIONS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

VARIOUS LOCATIONS

	Amount	Page No.
Office of Space Tracking and Data Systems:		
Modification and Relocation of 26-Meter Antenna, STDN, Goldstone, Calif. (JPL).....	4,700,000	CF 9-1
Relocation of the DSS-44 Antenna to Tidbinbilla, Australia (JPL).	2,200,000	CF 9-8
Total.....	6,900,000	

VARIOUS LOCATIONS
FISCAL YEAR 1982 ESTIMATES
MODIFICATION AND RELOCATION OF 26-METER ANTENNA, STDN, GOLDSTONE

LOCATION PLAN

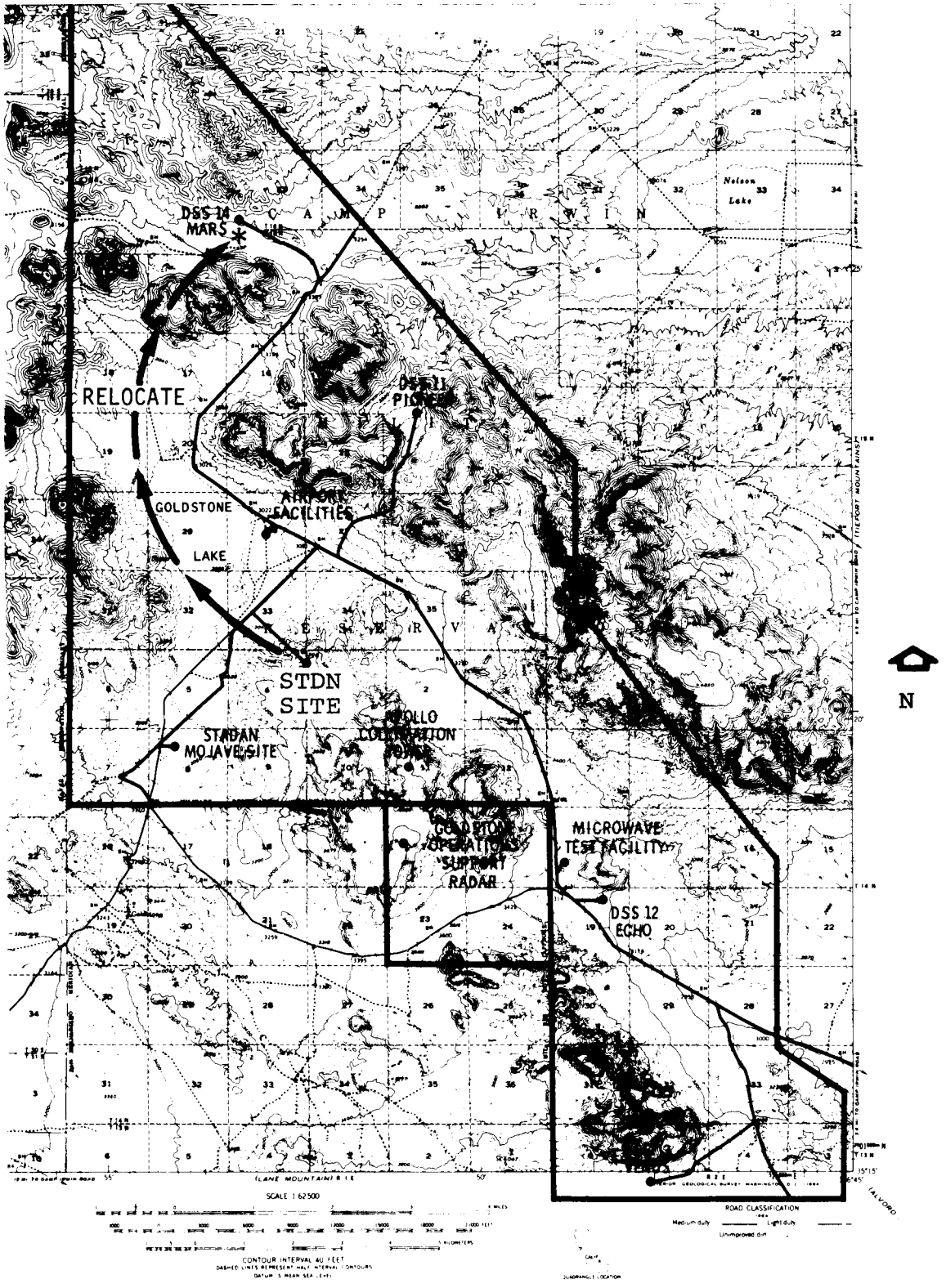


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Modification and Relocation of 26-Meter Antenna, STDN, Goldstone, California

INSTALLATION: Jet Propulsion Laboratory

FY 1982 CoF ESTIMATE: $4,700,000

LOCATION OF PROJECT: Goldstone, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Tracking and Data Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	275,000	---	275,000
Capitalized investment	N/A	534,611	534,611
Total	275,000	534,611	809,611

SUMMARY PURPOSE AND SCOPE:

Current and future NASA deep space missions are characterized by vastly increasing distances from earth. For mission communications, high frequencies (e.g., X-band) must be used by the spacecraft and the communication network to accurately determine the spacecraft's position in space and to achieve acceptable science data return. To achieve a substantial increase in data rate return, the aperture of the earth receiving station needs to be increased by enlarging the diameter of the antennas and by electronically arraying several antennas. This project provides resources to relocate the 26-meter Goldstone Space Tracking Data Network (STDN) antenna to a site adjacent to DSS-14 at Goldstone, convert it to operate at X-band frequencies, and to enlarge its

diameter to 34 meters. This antenna will be used as part of an array of five antennas in the Goldstone complex when completed to achieve a substantial increase in data rate return from deep space missions.

PROJECT JUSTIFICATION:

To provide data reception rates required for adequate Northern Hemisphere support of the Voyager encounter with Uranus in 1985, the antenna complex at Goldstone must be enhanced and modified to provide adequate coverage. To economically do this, the Goldstone complex requires an array of five X-band frequency antennas. DSS-14 and DSS-12, with 64-meter and 34-meter diameter reflectors respectively, operate at X-band frequencies. This project will provide for the relocation and conversion of the 26-meter STDN Antenna for operation at X-band frequencies with a 34-meter diameter reflector. This will be the third antenna of the five required for the array at the Goldstone complex.

The primary data mode for many ongoing and future planetary and interplanetary spacecraft requires the higher X-band frequencies and increased antenna aperture to achieve adequately high data rates and precision navigation and control at greater distances. The extended flight times to the outer planets and the relative positions of the planets produce a grouping of enroute spacecraft as seen from earth. This phenomenon makes it essential that the communications systems be capable of selectively distinguishing between distant spacecraft as navigational controls are exercised and science data is received. More antenna capability is required at each deep space communications complex to support the missions. Approved missions in flight in the mid 1980's will be in view at the same time and will require concurrent support. This requirement can be met only by enhancing the present deep space network capabilities.

IMPACT OF DELAY:

This portion of the Goldstone complex antenna array is required in the FY 1982 time frame to assure an operational capability by 1985 to adequately support the Voyager encounter with Uranus.

PROJECT DESCRIPTION:

This project relocates the STDN antenna (Figure 1) to a site adjacent to DSS-14 (Figure 2) and converts it for X-band frequency operation with a 34-meter diameter reflector. The relocation includes disassembly of the antenna at its present site and reassembly of it at the DSS-14 site, complete with a new foundation and strengthened structural joints. The reflector backup structure will be modified to increase the diameter to 34 meters, and the antenna's drive and control system will be modified for improved operation and energy efficiency. An antenna electronics building will be constructed to house racks of electronic equipment (Figure 2). All support utilities, paving (including an access road) and fire protection systems will also be provided.

PROJECT COST ESTIMATE:

A completed preliminary engineering report is the basis for this cost estimate.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	4,010,000
Relocation	LS	---	---	1,865,000
Antenna electronics building	LS	---	---	525,000
Reflector modifications	LS	---	---	1,140,000
Utilities, paving, and fire protection	LS	---	---	480,000
Equipment	---	---	---	690,000
Drive and control systems	LS	---	---	690,000
Fallout Shelter (not feasible)	---	---	---	---
Total				4,700,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - 34-Meter Cross-section

OTHER EQUIPMENT SUMMARY:

Electronic data handling equipment and radio frequency microwave equipment associated with the S-X conversion will be provided with R&D funding in the amount of $533,000 in FY 1982 and $1,961,000 in FY 1983.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future funding is required for this facility project. However, a future project planned for FY 1983 and estimated to cost $22 million is required to provide two 40-meter antennas at the Goldstone complex. They will complete the five antenna array.

VARIOUS LOCATIONS
FISCAL YEAR 1982 ESTIMATES
MODIFICATION AND RELOCATION OF 26-METER ANTENNA, STDN, GOLDSTONE

SITE PLAN

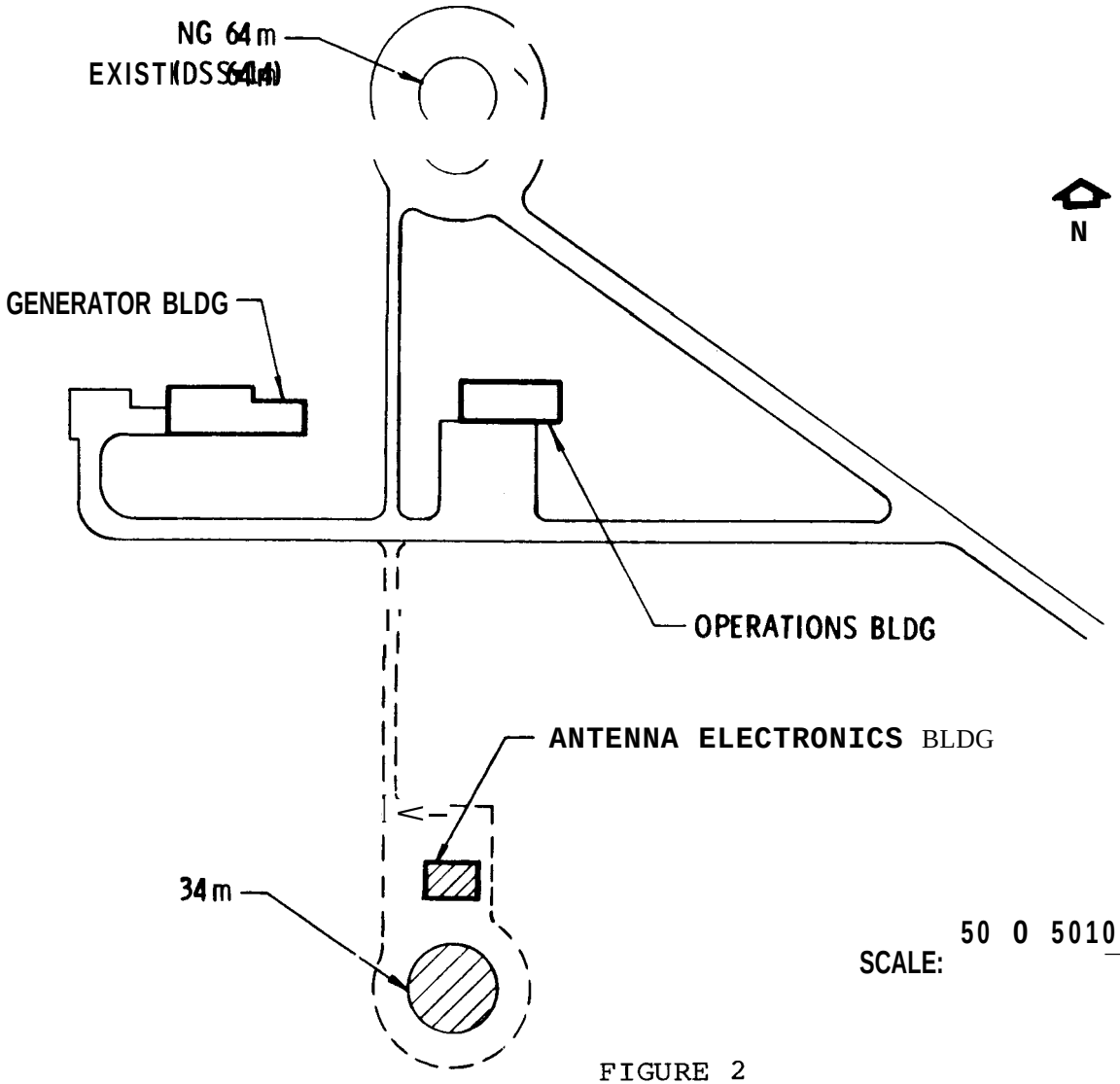


FIGURE 2

VARIOUS LOCATIONS
FISCAL YEAR 1982 ESTIMATES
MODIFICATION AND RELOCATION OF 26-METER ANTENNA, STDN, GOLDSTONE

34-METER CROSS-SECTION

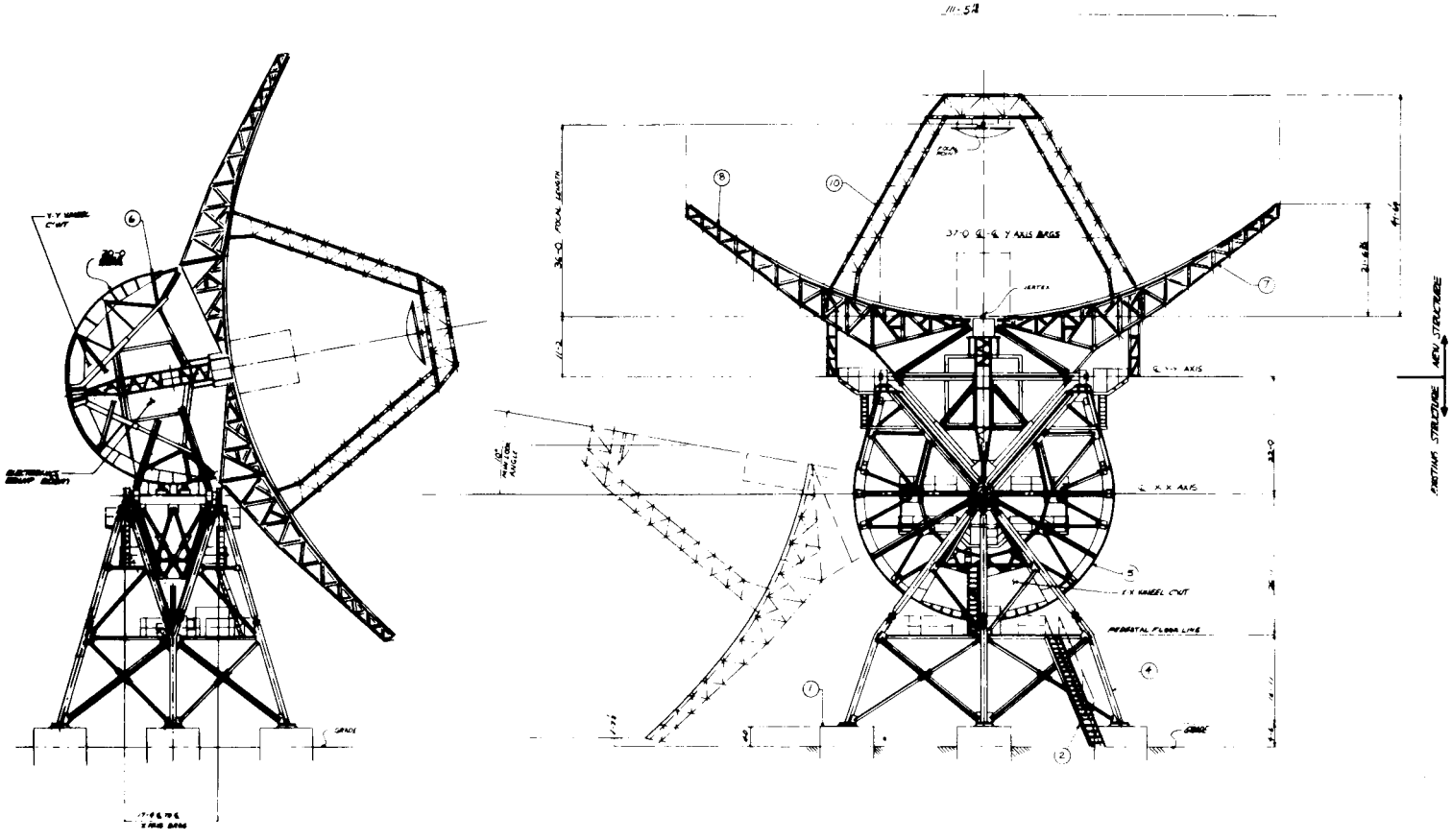


FIGURE 3

VARIOUS LOCATIONS
FISCAL YEAR 1982 ESTIMATES
RELOCATION OF **THE** DSS-44 ANTENNA TO TIDBINBILLA, AUSTRALIA

CF 9-8

LOCATION PLAN

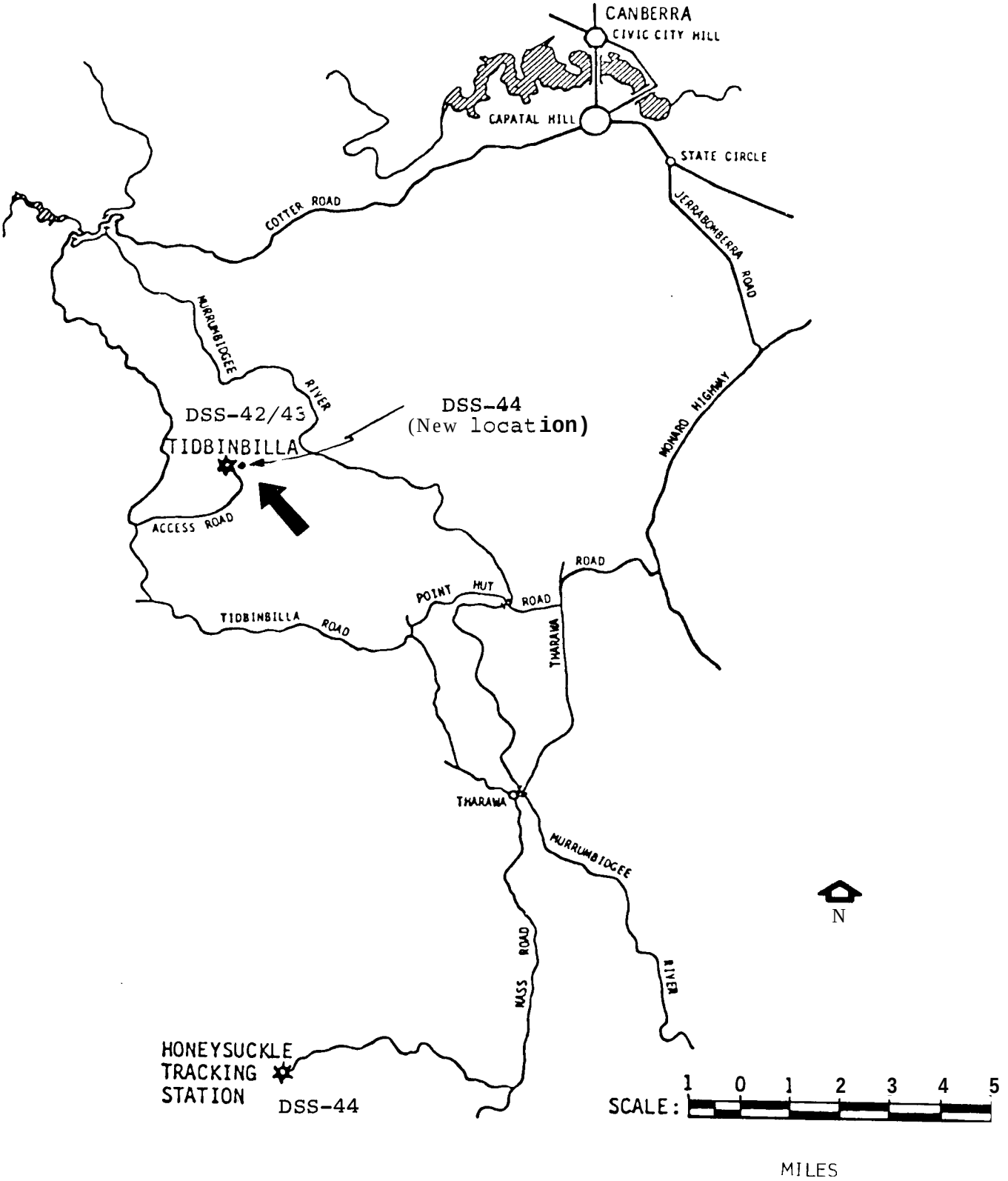


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Relocation of the DSS-44 Antenna to Tidbinbilla, Australia

INSTALLATION: Jet Propulsion Laboratory

FY 1982 CoF ESTIMATE: $2,200,000

LOCATION OF PROJECT: Canberra, Australia

COGNIZANT HEADQUARTERS OFFICE: Office of Space Tracking and Data Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	262,000	1,200,000	1,462,000
Capitalized investment.	N/A	11,092,458	11,092,458
Total....	262,000	12,292,458	12,554,458

SUMMARY PURPOSE AND SCOPE:

This project provides for the disassembly of the 26-meter diameter antenna at Honeysuckle Creek, Australia, DSS-44, and for its relocation and reassembly at a site adjacent to the antennas at the Canberra Deep Space Communications Complex (CDSCC) at Tidbinbilla, Australia (Figure 1). Included are an antenna electronics building, utilities, paving and fire protection. The antenna is also scheduled to be upgraded for operation at X-band frequencies as part of the S-X conversion (Figure 3) provided for in the FY 1981 CoF program. The conversion includes enlarging the 26-meter diameter primary reflector to 34 meters.

Current and future NASA deep space missions are characterized by vastly increasing distances from earth. Communication over these distances can be accomplished by using higher frequencies for data transmission and larger earth station apertures than exist. The S-X conversion and relocation of this antenna will enable it to be arrayed with other X-band antennas at the Tidbinbilla complex for providing the aperture increase required for these deep space missions.

PROJECT JUSTIFICATION:

To provide data rates required for adequate support of the Voyager encounter with Uranus in 1985, the antenna complex at Tidbinbilla must be enhanced to enable adequate Southern Hemisphere coverage. To do this, the Tidbinbilla complex will require an array of four X-band antennas. Two existing antennas, DSS-43 and DSS-42, have 64-meter and 34-meter diameter reflectors and both operate at X-band frequencies. This project provides the third antenna of a planned array of four antennas. A future project, planned for for FY 1983, will provide for relocation of the Orroral Valley antenna to Tidbinbilla and for similar S-X conversion of it to 34 meters. This will complete the antenna array in time to provide adequate support for the 1985 Uranus encounter. These relocations, S-X conversions to larger diameters, and arraying will cost effectively provide the required operational capability.

Substantial cost avoidance benefits will also be realized from this project. Planned upgrades of the power generation and distribution systems and installation of the technical facilities controllers will not be required at the Honeysuckle location by closing the station. Other cost savings will be realized by closing the Honeysuckle station thereby reducing maintenance and operation requirements including logistics, staffing and provisions of services such as guards, cafeteria, and maintenance personnel and power house operators.

IMPACT OF DELAY:

This portion of the Tidbinbilla Complex antenna array is required in the FY 1982 time frame to assure an operational capability by 1985 for adequately supporting the Voyager encounter with Uranus.

PROJECT DESCRIPTION:

This project provides for the disassembly of the 26-meter antenna located at Honeysuckle Creek, Australia, **DSS-44.** The disassembly will be phased appropriately with the scheduled FY 1981 S-X conversion of the antenna. The antenna will be relocated to the Tidbinbilla complex and reassembled on a new foundation. A new antenna electronics building will be constructed for housing racks of electronic equipment (Figure 2). Supporting utilities, site paving (including an access road), and fire protection systems will also be provided.

PROJECT COST ESTIMATE:

This cost estimate is based on a completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	—	---	---	---
Construction....	—	---	---	2,200,000
Disassembly, relocation and reassembly	LS	---	---	1,220,000
Antenna electronics building	Is	—	---	520,000
Utilities, paving and fire protection..	LS	---	---	460,000
Equipment	—	---	---	---
Fallout Shelter (not feasible)..	—	---	---	---
Total.....				2,200,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - 34-Meter Cross-section

OTHER EQUIPMENT SUMMARY:

No other equipment is required for this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future funding is required to complete this project. A future project is planned for FY 1983 at approximately $5.0 million to complete the array of four X-band antennas at the Tidbinbilla complex. Included will be the relocation of the 26-meter Space Tracking Data Network (STDN) antenna from the Orroral Valley to Tidbinbilla as well as its S-X conversion to 34 meters. The provision of commercial electrical power for Tidbinbilla is also being considered for a future program.

VARIOUS LOCATIONS
FISCAL YEAR 1982 ESTIMATES
RELOCATION OF THE DSS-44 ANTENNA TO TIDBINBILLA, AUSTRALIA

SITE PLAN

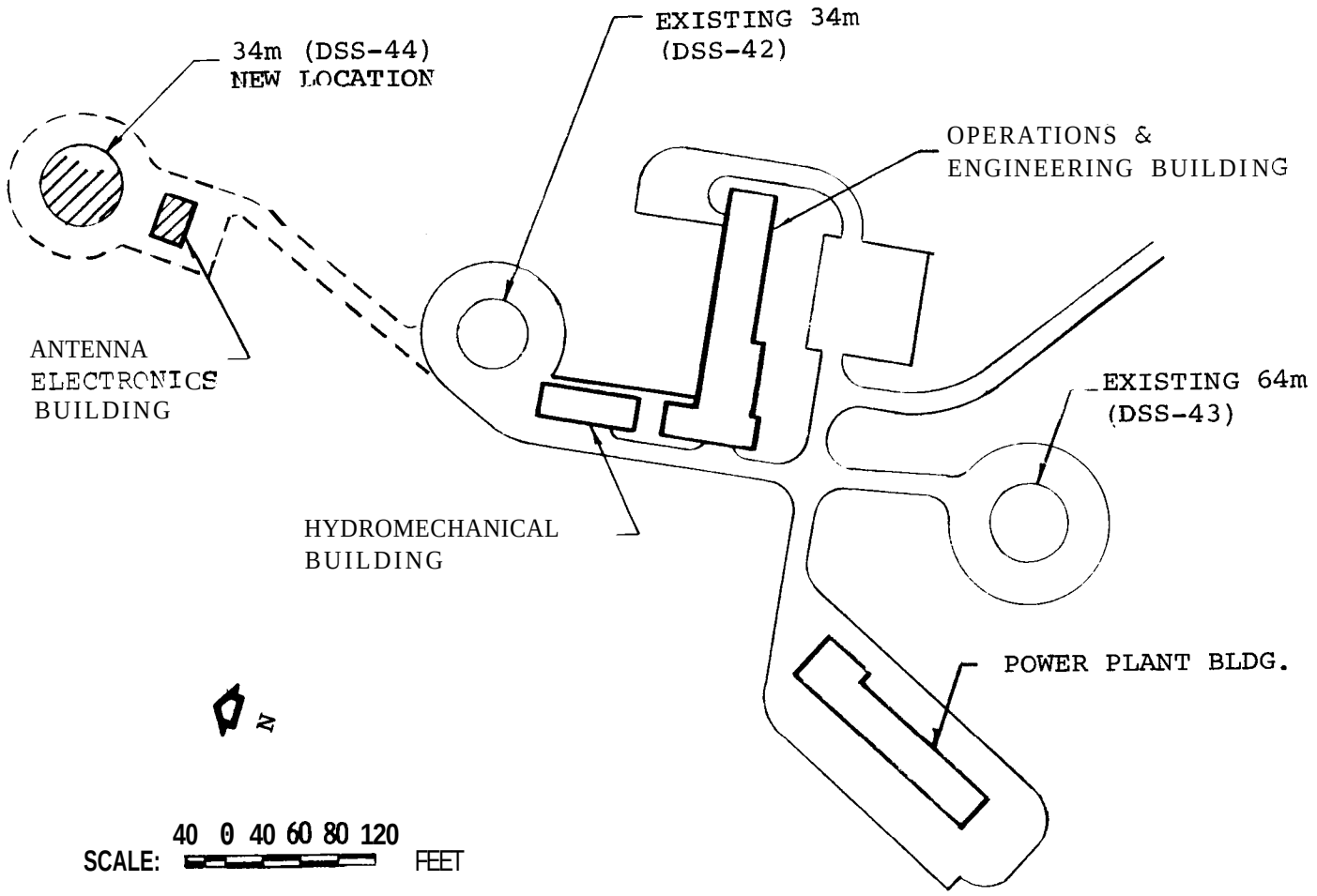


FIGURE 2

VARIOUS LOCATIONS
FISCAL YEAR 1982 ESTIMATES
RELOCATION OF THE **DSS-44** ANTENNA TO TIDBINBILLA, AUSTRALIA

34-METER CROSS-SECTION

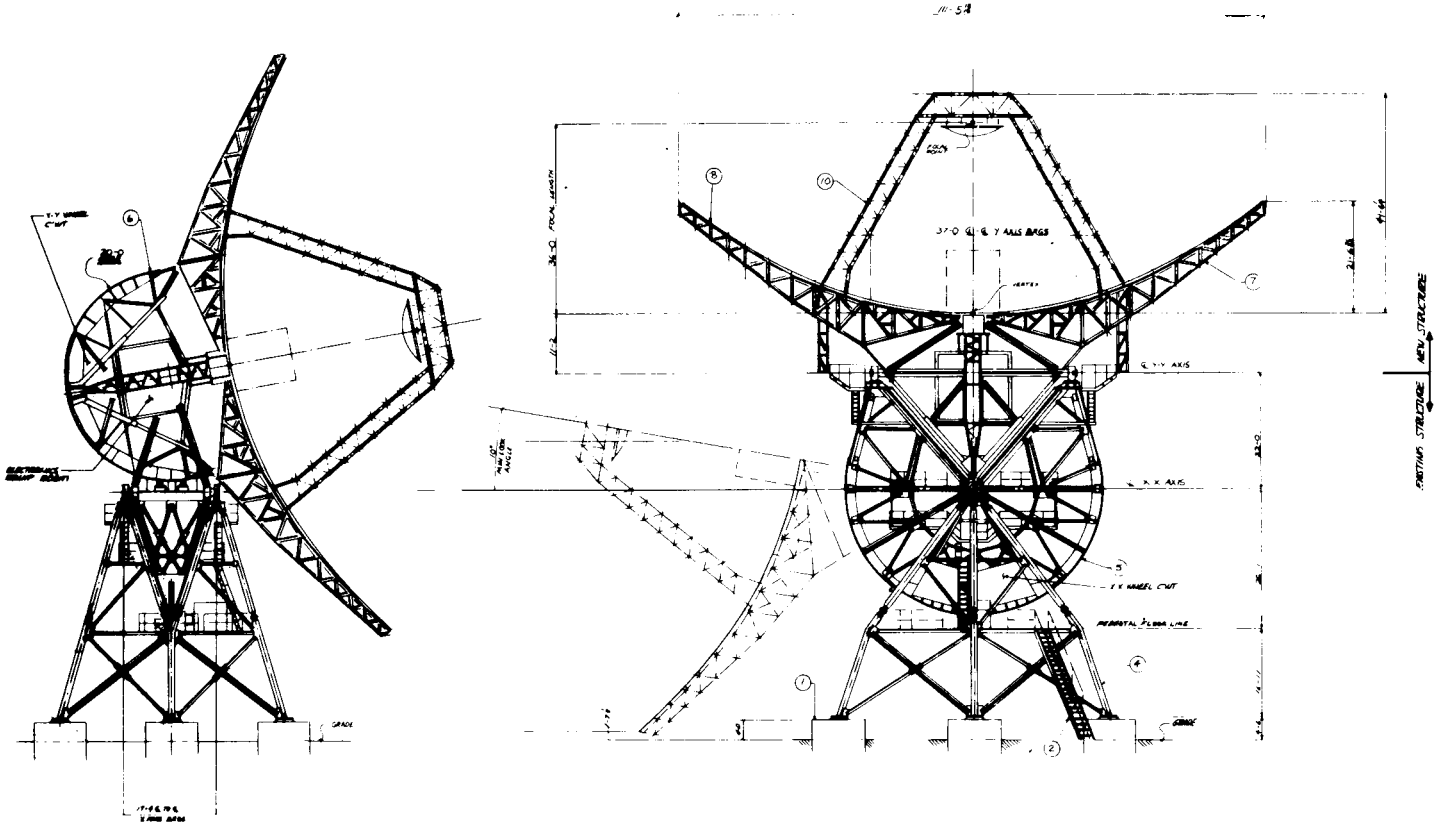


FIGURE 3

SPACE SHUTTLE
FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

SPACE SHUTTLE FACILITIES

	Amount	Page No.
Office of Space Transportation Systems:		
Summary		CF 10-1
Launch and Landing Facilities	15,500,000	
Construction of Solid Rocket Booster Processing and Segment Storage Facilities, Kennedy Space Center	12,400,000	CF 10-4
Modification to Firing Rooms, Kennedy Space Center	3,100,000	CF 10-12
Manufacturing and Final Assembly Facilities	2,785,000	
Modifications of Manufacturing and Final Assembly Facilities for External Tanks, Michoud Assembly Facility	2,785,000	CF 10-19
Ground Test Facilities	650,000	
Modifications to Building 30 for Shuttle Operations, Johnson Space Center	650,000	CF 10-26
Minor Facilities	1,115,000	
Minor Shuttle-Unique Projects, Various Locations	1,115,000	CF 10-44
Total	20,050,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE:	Space Shuttle Facilities
INSTALLATION:	Various Locations
FY 1982 CoF ESTIMATE:	$20,050,000

LOCATION OF PROJECT: Locations are identified in the following documentation.

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	6,441,685	80,901,812	87,343,497
Capitalized investment	N/A	151,036,225	151,036,225
Total	6,441,685	231,938,037	238,379,722

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to rehabilitate, modify, and add to existing Government-owned facilities, and to construct new facilities to meet unique requirements of the Space Shuttle Program. As in prior years, this Shuttle facilities package includes all major facility requirements unique to the Space Shuttle program. In FY 1982, the proposed Shuttle facilities are primarily related to the construction of Solid Rocket Booster (SRB) processing and segment storage facilities at Kennedy Space Center (KSC) to reduce risk to personnel and flight hardware. Also included are modifications to the launch firing rooms at KSC, modifications to support external tank (ET) manfacturing and final assembly at Michoud Assembly Facility (MAF), modifications to the

mission control center at Johnson Space Center (JSC) and minor Space Shuttle unique rehabilitation and modification projects required to support the Space Shuttle program.

PROJECT JUSTIFICATION:

Prior year CoF budgets for the Space Shuttle Program authorized modifications and construction of facilities for technical development, Space Shuttle main engine tests, ground tests, manufacturing, and launch and landing. All of the facilities to support the first Manned Orbital Flight and the Design, Development, Test and Evaluation portion of the program are completed and operational. The major project in this funding request is for construction of SRB processing and segment storage facilities at KSC. This project is required because recent assessments and accumulated evidence indicate that the processing of SRB segments in the Vertical Assembly Building, as previously planned, pose more of a safety hazard than was envisioned. Other projects included are modifications to a firing room at KSC and mission control center at JSC to support increase flight rates and associated software production during mission operations and continuation of modifications to manufacturing facilities for ET's to meet production needs. Detailed justifications are included in the project documents that follow.

As in previous requests, the projects included have been carefully reviewed against operational projections and mission capabilities to insure that they are not prematurely requested.

PROJECT COST **ESTIMATE**:

Launch and Landing Facilities	15.500. 000
Construction of Solid Rocket Booster Processing and Segment Storage Facilities. Kennedy Space Center	12.400. 000
Modification to Firing Rooms. Kennedy Space Center	3.100. 000
Manufacturing and Final Assembly Facilities	2.785. 000
Modifications of Manufacturing and Final Assembly Facilities for External Tanks. Michoud Assembly Facility	2.785. 000
Ground Test Facilities	650. 000
Modifications to Building 30 for Shuttle Operations. Johnson Space Center	650 ,000
Minor Facilities	1 115. 000
Minor Shuttle–Unique Projects. Various Locations	1,115.000
Total	20.050. 000

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
CONSTRUCTION OF SOLID ROCKET BOOSTER
PROCESSING AND SEGMENT STORAGE FACILITIES

LOCATION PLAN

CF 10-4

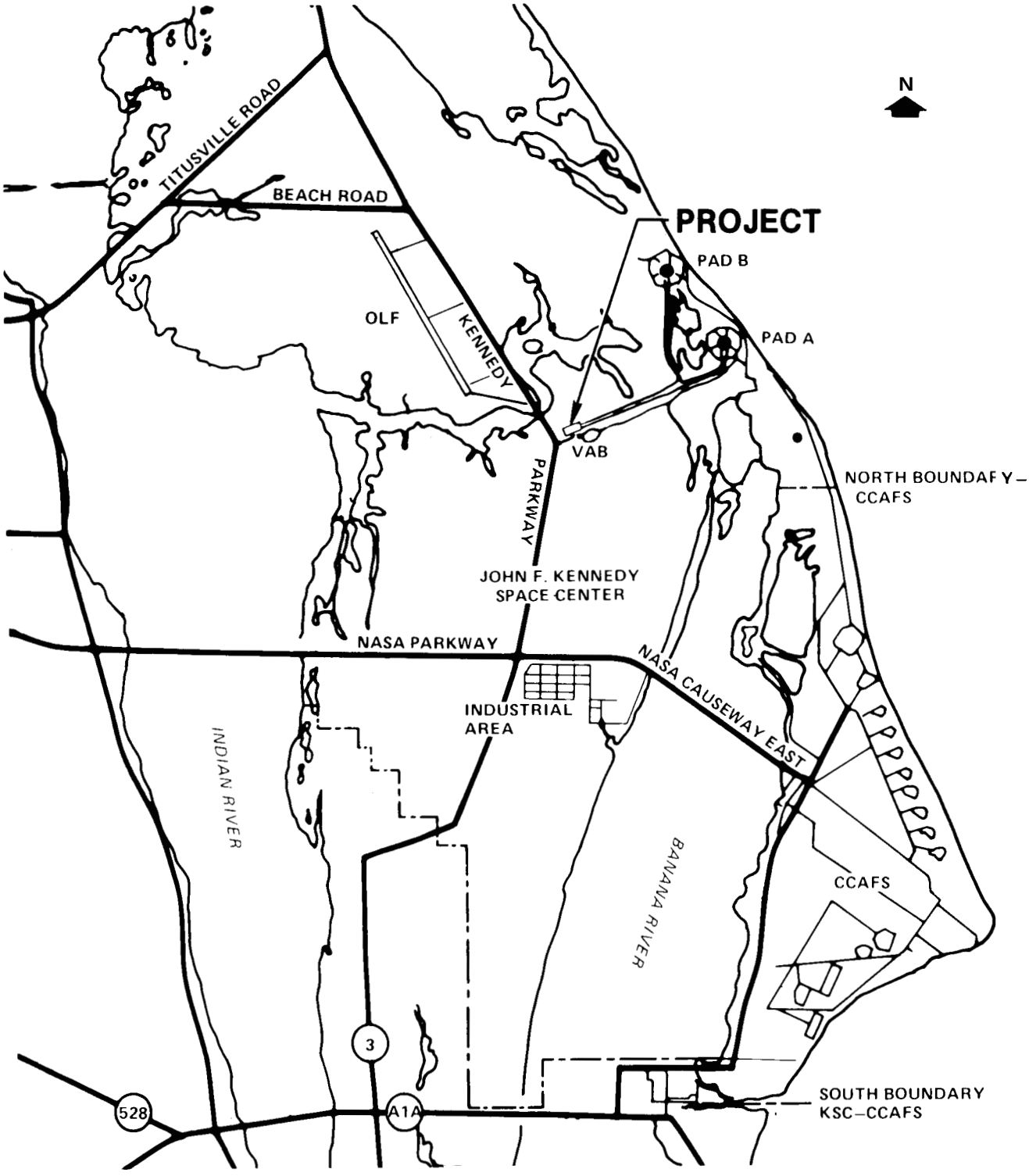


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Construction of Solid Rocket Booster Processing and Segment Storage Facilities

INSTALLATION: John F. Kennedy Space Center

FY 1982 CoF ESTIMATE: $12,400,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	854,685	4,347,205	5,201,890
Capitalized investment	N/A	---	---
Total	854,685	4,347,205	5,201,890

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a solid rocket booster (SRB) processing facility and two SRB segment storage facilities at the Kennedy Space Center (KSC) (Figures 1 and 2). These facilities will be located in the LC-39 area at a suitable safe distance from existing facilities. The separation of the majority of SRB processing and storage from other space shuttle activities in the LC-39 area will enhance the safety of these other operations because of the hazardous nature of the SRB segments themselves.

The processing facility will house all SRB activities, except final "stacking" of SRB segments on the mobile launch platform, which is conducted in the Vehicle Assembly Building (VAB). These SRB activities include railcar offloading, rotating, inspecting, aft segment buildup, and railcar loading of the spent casings. The aft segment workstands now located in the high bay VAB will be relocated to this facility.

Two metal buildings will comprise the SRB storage facilities. One will be of sufficient size to house eight (8) segments. The other building will house six (6) segments, giving a total storage capacity of two (2) flight sets including the two (2) segments involved in aft segment buildup.

PROJECT JUSTIFICATION:

The two SRB's burn in parallel with the main propulsion system of the Orbiter to provide initial ascent thrust. An assembled SRB contains 1,100,657 pounds (500,299 kilograms) of propellant, having a thrust of 2,650,000 pounds (11,800,000 Newtons). Each SRB is composed of four solid propellant filled segments, a nose fairing, a forward skirt, and an aft skirt.

The SRB segments are shipped by rail from the contractor facility to KSC. SRB processing at KSC includes off-loading a segment, conducting a receiving inspection for possible shipping damage, and storing the segment until further processing is required. At the appropriate time, the aft skirt and aft SRB components are mated for stacking on the mobile launch platform. All of these processing activities are presently conducted in the Vehicle Assembly Building (VAB).

During the last five years, evidence has accumulated indicating that the processing of SRB segments in the VAB poses more of a safety hazard than was originally envisioned. Various studies and hazard analyses have shown that the inadvertent ignition of an SRB segment in the VAB could be catastrophic in terms of loss of life and major damage to shuttle flight hardware and to the VAB itself. The actual inadvertent ignition of a seven-foot diameter segment at United Technologies Corporation (UTC) in 1979 has shown that such an accidental ignition is possible, as well as sympathetic ignition of other segments. The risk to personnel, flight hardware, and the VAB can be significantly reduced by removing as much SRB segment processing and storage from the VAB as is practicable. This project provides a dedicated facility for SRB processing, to include the off-loading, inspecting, and building up of aft segment activities.

The project also provides two storage facilities for the SRB segments. The total storage capacity provided will be for sixteen (16) SRB segments including two (2) segments in the aft buildup stands. The VAB presently has in-process storage for approximately eight (8) segments including working storage in the aft segment workstands and temporary positions on the floor of High Bay 4. For the safety concerns cited above, SRB storage will be removed from the VAB. This minimal contingency storage is required to preclude launch delays due to

delays due to an unforeseen unavailability of SRB segments. The total of sixteen (16) segments will meet the shuttle program requirements for storage during the early operational phase.

IMPACT OF DELAY:

Delaying this project will mean continuing to perform all SRB processing in the VAB with the inherent risk of an inadvertent segment ignition. In addition to loss of life, a major consideration is severe damage to an Orbiter and other flight hardware, the mobile launch platform, or to the VAB itself.

Failure to provide SRB segment contingency storage could have an adverse impact on flight schedules should circumstances interrupt the timely delivery of segments to KSC.

PROJECT DESCRIPTION:

This project provides for the construction of a 20,000-square foot (1,800 square meter) building to house SRB segment off-loading, inspecting, and aft segment buildup activities (Figure 3). This 218-foot by 90-foot (65.4 meter by 27.0 meter) facility will be serviced by a new 200-ton crane and will house one set of the aft segment buildup workstands which will be relocated from High Bay 2 of the VAB. The processing area will also be serviced by an on-hand 125-ton crane which will be relocated from High Bay 2 of the VAB. A 700-foot (210 meter) railspur will be constructed for direct delivery of segments to the facility. Associated utilities, a road and a 100-foot by 79-foot (30.0 meter by 23.7 meter) operations support building will also be provided.

The storage facilities will consist of two metal buildings, one measuring 55 feet by 135 feet (16.5 meters by 45 meters) and the other 55 feet by 100 feet (16.5 meters by 33 meters). The buildings will be erected on concrete pads and will be separated from each other and from the processing facility by approximately 600 feet (180 meters). Power for lighting and a fire protection system will be provided in each facility. A road network will connect the storage facilities with the processing facility.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report and related studies.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	10,798,000
Site work	LS	---	---	439,000
Utilities	LS	---	---	955,000
Railroad	LS	---	---	498,000
Six-segment storage building	LS	---	---	1,236,000
Eight-segment storage building	LS	---	---	1,620,000
Support building	---	---	---	600,000
Architectural/structural	LS	---	---	(390,000)
HVAC	LS	---	---	(110,000)
Electrical	LS	---	---	(100,000)
Processing building	---	---	---	5,450,000
Structural	LS	---	---	(2,480,000)
Architectural, exterior	LS	---	---	(1,397,000)
Architectural, interior	LS	---	---	(324,000)
Work platforms	LS	---	---	(649,000)
HVAC	LS	---	---	(104,000)
Electrical	LS	---	---	(496,000)

	Unit of Measure	Quantity	Unit cost	cost
Equipment	---	---	---	1.602.000
200-ton crane	EA	1	1,335,000	1,335,000
Equipment elevator	EA	1	267,000	267,000
Fallout Shelter (not feasible)	---	---	---	---
Total				12,400,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Floor Plan, Processing Facility and Operations Support Building

OTHER EOUIPMENT SUMMARY:

Certain items of non-collateral equipment will be required to make these facilities operational. These include storage handling pallets, storage covers, a rubber-tired transporter, and a handling and rotation beam. These items will cost approximately $2,100,000 and be provided with R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Future CoF funding may be required to relocate the second set of aft workstands from the VAB to a future addition to this SRB processing facility or an additional separate processing facility if required. The cost of these options cannot be validated at this time. It is also possible that future contingency storage of SRB segments may be required. The need, location, and cost of this storage have not yet been determined.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
CONSTRUCTION OF SOLID ROCKET BOOSTER PROCESSING AND SEGMENT STORAGE FACILITIES

SITE PLAN

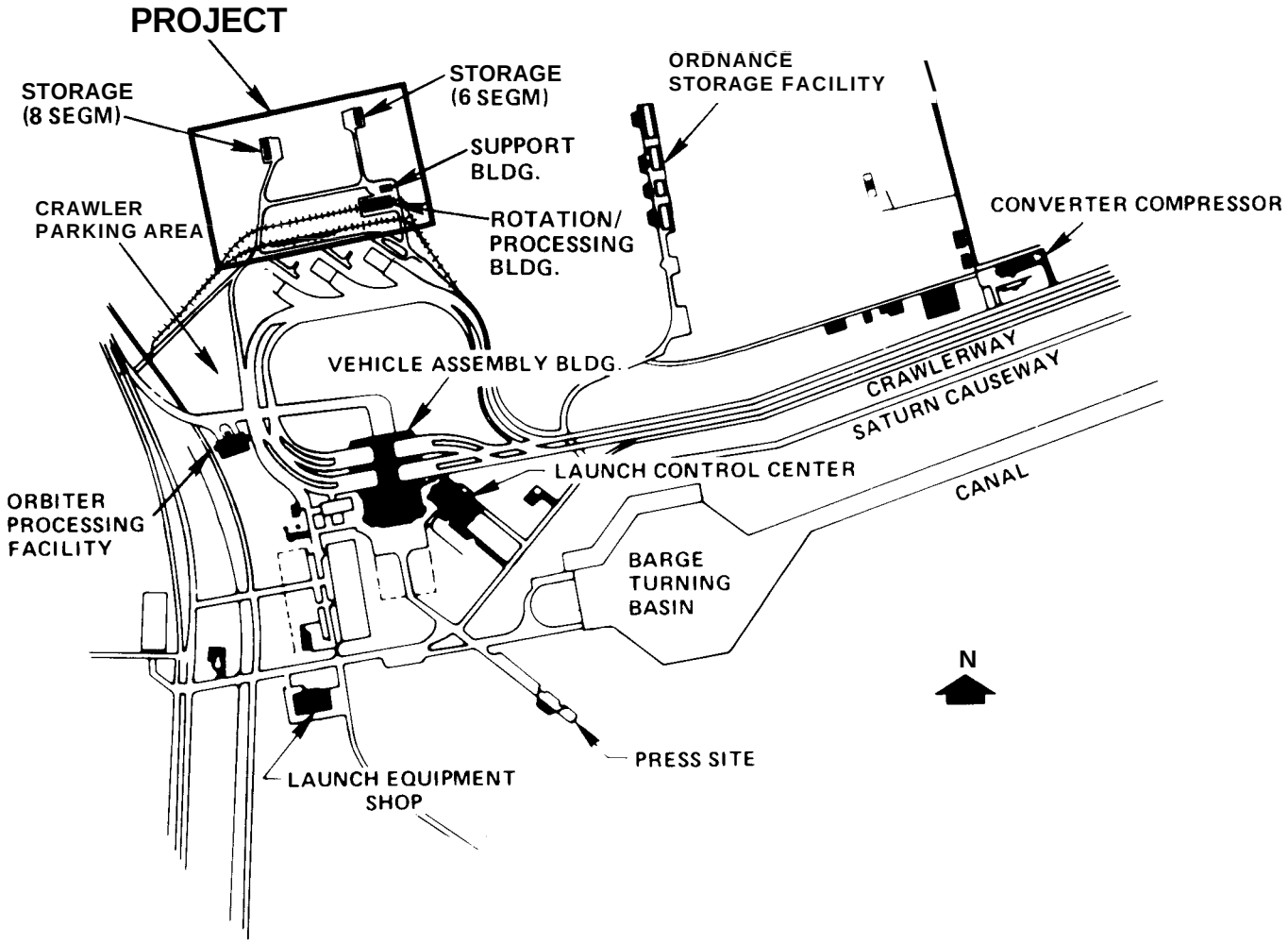


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
CONSTRUCTION OF SOLID ROCKET BOOSTER
PROCESSING AND SEGMENT STORAGE FACILITIES

FLOOR PLAN

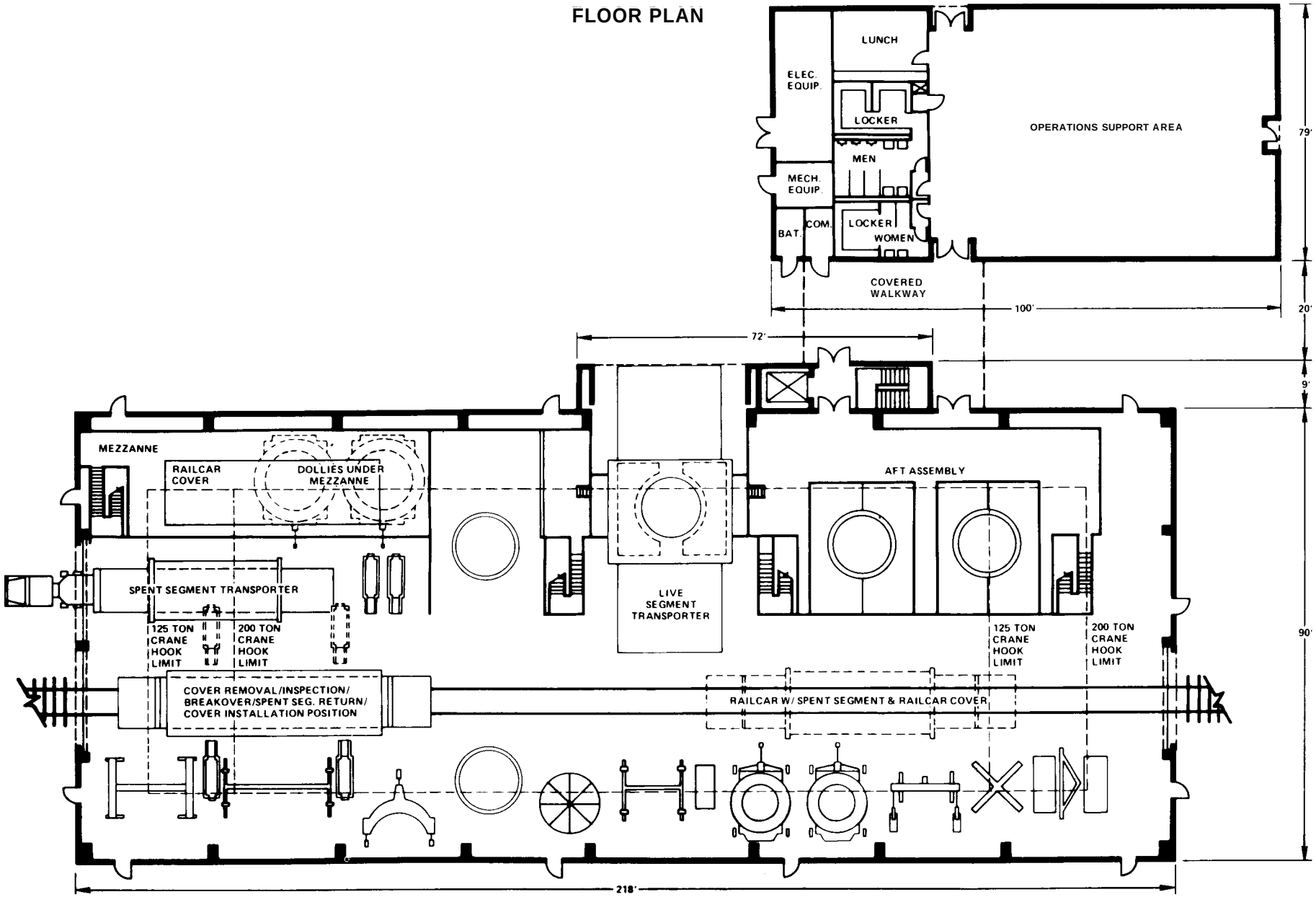


FIGURE 3

CF 10-11

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO FIRING ROOMS

LOCATION PLAN

CF 10-12

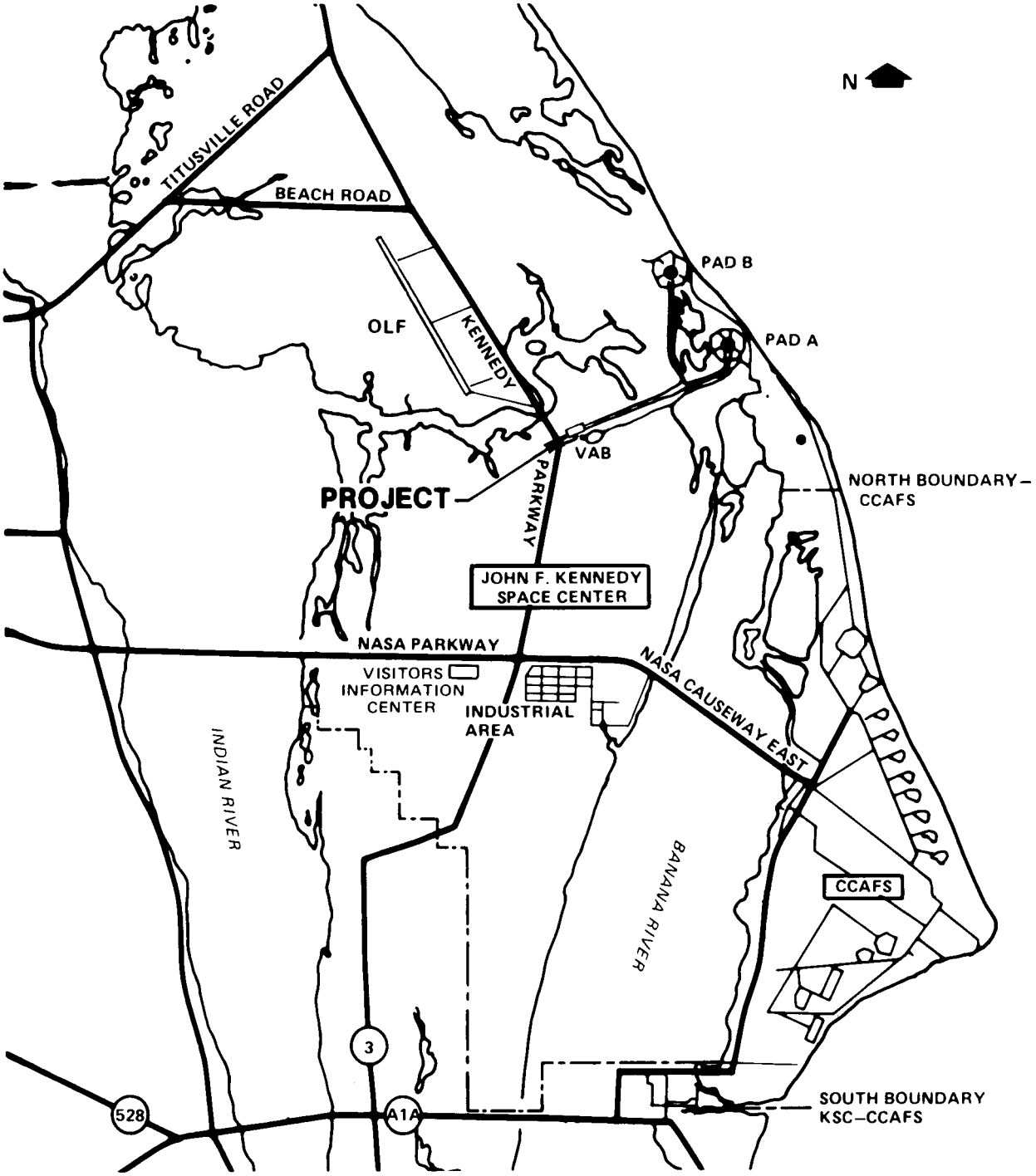


FIGURE 1

PROJECT TITLE: Modifications to Firing Rooms

INSTALLATION: John F. Kennedy Space Center

FY 1982 CoF ESTIMATE: $3,100,000

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	276,000	2,799,107	3,075,107
Capitalized investment	N/A	11,322,559	11,322,559
Total	276,000	14,121,666	14,397,666

SUMMARY PURPOSE AND SCOPE:

This project modifies the Launch Control Center (LCC) to provide an additional operational firing room for the checkout and launch of the Space Shuttle (Figures 1 and 2). Experience with the Launch Processing System (LPS) shows that an operational firing room must be dedicated to tracking each Orbiter vehicle in flow through the various Kennedy Space Center (KSC) facilities. An additional firing room is needed to support the LPS activities associated with two Orbiter vehicles in flow which is scheduled to occur in CY 1982. The area in the LCC to be modified, Firing Room 3 (FR-3), is still configured as an Apollo firing room. The required work includes: modifications to the air-conditioning and electrical systems; modifications to the racks, walls,

and raised floors; installation of a fire protection system; and the re-routing of the uninterruptible power system (UPS) cable from Firing Room 2 (FR-2) to FR-3.

PROJECT JUSTIFICATION:

Fiscal Year 1976 CoF funding provided for modifications to Firing Rooms 1 and 2 on the third floor of the LCC to house the Checkout Control and Monitor Subsystem (CCMS) of the LPS, and to other rooms on the second level of the LCC for installation of the LPS Central Data Subsystem (CDS).

The configuration of Firing Rooms 1 and 2 is sufficient to support the first manned orbital flight. Firing Room 1 (FR-1) is an operational firing room presently involved in the checkout and launch activities associated with STS-1. Firing Room 2 (FR-2) provides the necessary software production support for these activities.

Experience with the LPS has shown that an entire firing room must be dedicated to the processing of an Orbiter vehicle from the time it enters the Orbiter Processing Facility (OPF) until it is launched at the pad. Since the LPS was originally sized, there have been numerous program refinements which have necessitated longer processing times than were originally envisioned. Factors affecting the LPS which have evolved since original sizing include a four-to-five fold increase in flight vehicle measurements to be processed, and extended test time for both flight and ground equipment.

Firing Rooms 1 and 2 provide the required LPS capability until late FY 1982 when Orbiter 099 is scheduled to arrive at KSC. Once there are two Orbiter vehicles in flow, an additional operational firing room will be required so that LPS processing can be accomplished and the necessary software production activities can meet the planned flight rates.

This need for an additional operational firing room is also phased with the need to provide a number of security modifications for specific DOD missions. While the Air Force will fund the facility work associated with the unique security requirements, it is impractical to curtail operations in either FR-1 or FR-2 in order to do the modifications. Activating FR-3 satisfies both NASA and Air Force needs in the proper timeframe. This will allow uninterrupted use of FR-2 for software production while FR-3 is being activated, and avoid a shutdown of FR-2 during a critical need period. Considerable operational advantages are also realized by having the unclassified firing room (FR-1) and the software production facility (FR-2) contiguous for mutual equipment scheduling and use. This project provides the necessary modifications to the LCC to allow expansion of the LPS to support currently planned Space Transportation System (STS) operations.

IMPACT OF DELAY:

Delaying the project would deny the capability for supporting the simultaneous processing of two Orbiters at KSC and would not meet software development requirements necessary to support the planned flight rates.

PROJECT DESCRIPTION:

Two firing rooms (FR-2 and FR-3) on the third floor of the LCC will be modified to provide Shuttle prelaunch/launch support (Figure 3). Firing Room 2 will be maintained for software production. Firing Room 3 will be established as an operational firing room.

The modifications include removing and/or modifying racks, partitions, walls and doors, and chilled water systems including relocating and installing air-conditioning equipment; modifying raised floors; providing a fire detection and extinguishing system; and extensive electrical modifications. Standard layouts for the control consoles, which will monitor separate functions of the Shuttle launch, and will be connected to the Central Data Subsystem on the second floor, will be used in the firing rooms. Cutouts in the raised flooring will be required to accommodate the consoles. Existing racks and their associated underfloor cables, wireways, and receptacles will be removed; partions, walls, doors, raised floors, and air-conditioning and electrical systems will be modified. Additional air handling units will be installed to insure adequate cooling for the computer system and emergency power will also be provided. Instrumentation and power circuits will be expanded and reconnected to accommodate the new arrangment of the consoles.

Although a fire detection and alarm system is currently installed in the areas to be modified, a fire control and extinguishing system does not exist in FR-3. A fire extinguishing system, which will incorporate the present detection and alarm system, will be installed in FR-3. The system will include the critical areas above ceilings, under raised floors, and inside racks and consoles which is necessary to protect the high value equipment housed in the LCC and permit continued operations.

PROJECT COST ESTIMATE:

This cost estimate is based on related engineering studies.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	3,100,000
Architectural/structural	LS	---	---	401,000
Air-conditioning	LS	---	---	760,000
Electrical	LS	---	---	1,305,000
Fire protection	LS	---	---	634,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				3,100,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - LCC Floor Plan

OTHER EOUIPMENT SUMMARY:

Noncollateral equipment, estimated to cost up to $40,000,000, will be required to support initial operations. This includes necessary monitoring, control, and communications equipment needed for the LPS function.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is anticipated.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO FIRING **ROOMS**

SITE PLAN

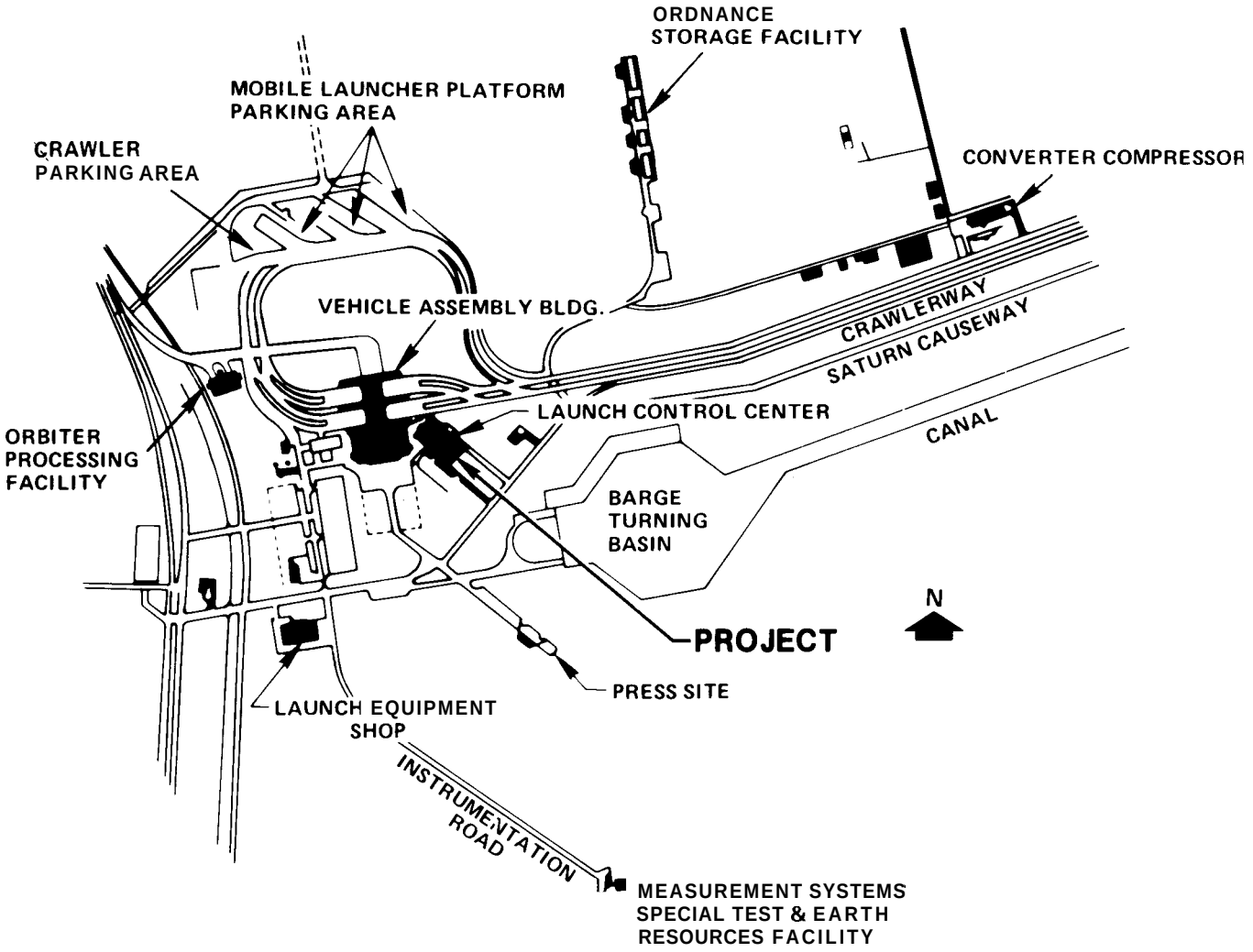


FIGURE 2

JOHN F. KENNEDY **SPACE** CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO FIRING ROOMS

FLOOR PLAN

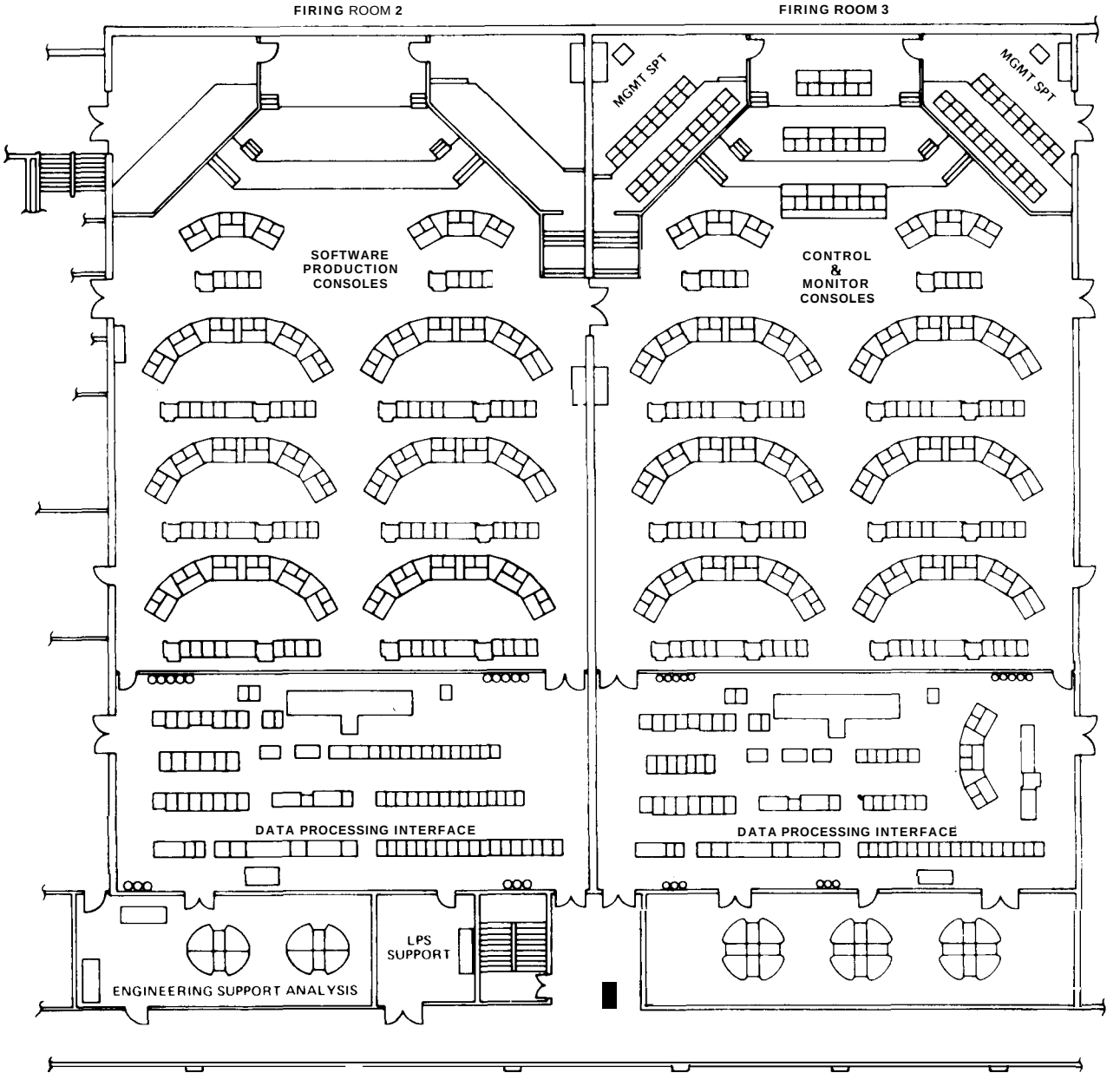


FIGURE 3

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES
FOR EXTERNAL TANKS

LOCATION PLAN

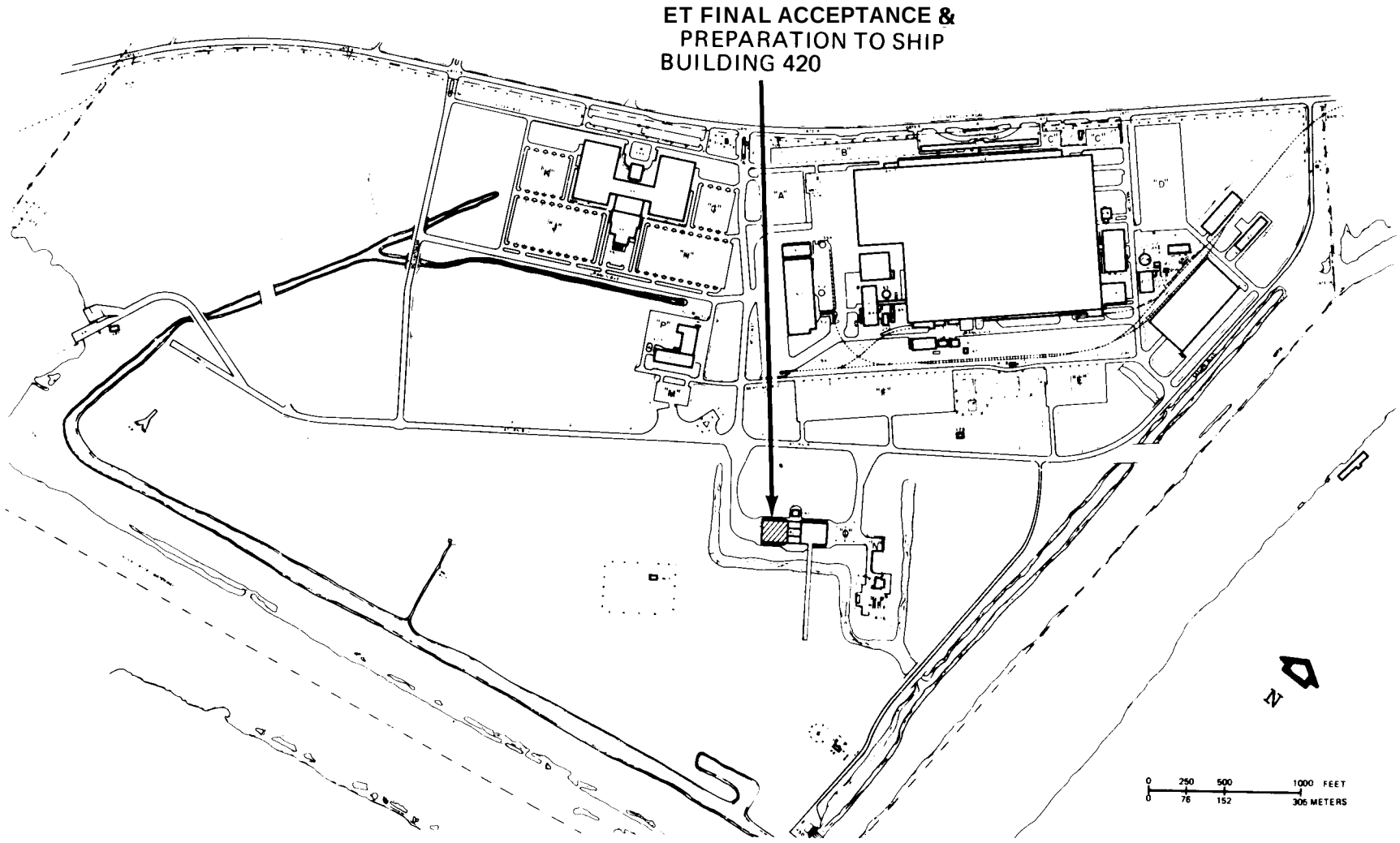


FIGURE 1

CF 10-19

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE:	Modification of Manufacturing and Final Assembly Facilities for External Tanks
INSTALLATION:	Michoud Assembly Facility
FY 1982 CoF ESTIMATE:	$2,785,000

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	4,278,000	61,341,500	65,619,500
Capitalized investment	N/A	128,550,000	128,550,000
Total.....	4,278,000	189,891,500	194,169,500

SUMMARY PURPOSE AND SCOPE:

This project continues work funded in Fiscal Year 1981 and prior years for modification of manufacturing and final assembly facilities at the Michoud Assembly Facility (MAF) for the Space Shuttle External Tank (ET) production. The ET is the component of the Space Shuttle that supplies propellants to the Orbiter's main engines. Each ET consists of three major components: a liquid oxygen (LO_2) tank, an intertank and a liquid hydrogen (LH_2) tank. The Space Shuttle facility work at MAF is required to provide capability for fabrication and assembly testing and cleaning, application of a thermal protection system (TPS) and major component assembly

of the ET. The tank is also equipped kith plumbing and electrical systems, and then checked and accepted prior to being shipped to the launch site where it will be mated with the Oribiter and Solid Rocket Boosters.

Prior years resources provided phased modifications to the Main Manufacturing Building, Building 103, the Vertical Assembly Building (VAB), Building 110, and the Final Acceptance and Checkout Building, Building 420. Included were construction of a High Bay Addition, Building 114; a facility to apply thermal protection system (TPS) coating to the LO_2 tank and the intertank; a facility for cleaning, priming and applying ablator foam to the LH_2 tank, Building 131; and a pneumatic proof test facility for the LH_2 tank, Building 451.

This project provides for the rehabilitation of the ET Final Acceptance and Preparation to Ship Positions in Building 420. Final acceptance of the assembled ET is conducted in this building prior to shipment to the launch site. Activities performed here include determining the actual weight and center of gravity of the assembled ET; end-to-end sensor checks to verify that all wiring is intact and that all sensors are connected and working; mechanical joint leak test of the ET; propellant vent valve function tests; TPS closeout around individual brackets, propellant feed lines, vent lines, and cabling system; and a combined system test to verify all systems are operational and functioning as programmed. These resources provide for the precise environmental conditions required for TPS closeout operations, repair and upgrading of the floor in one of the two cells being used in Building 420, and providing a compressor system to supply flight grade air for purging the intertank and LH_2 tank.

PROJECT JUSTIFICATION:

The majority of the TPS is applied to the major ET components during production, with a final TPS closeout application necessary after assembly and checkout to assure all exposed surfaces are insulated. These closeouts must be made under controlled temperature, humidity and cleanliness conditions. Certain ET areas are "closed out" by spraying, while smaller areas are "closed out" by pouring foam. Also, premolded sections of TPS are used to form external aerodynamic configurations around various protrusions where inaccessibility precludes spray operations. Closeout operations are most critical on areas where the insulation is bonded to surfaces subject to cryogenic temperatures. Areas not properly coated with foam, especially on the protrusions, can result in ice formations that could be dislodged. This could result in ice damage to the orbiter vehicle tiles during assent. This project provides the controlled temperature, humidity and cleanliness conditions required to successfully perform the TPS closeout operations which are greatly affected by local temperature and humidity fluctuations.

The existing concrete floor slab in one of the two cells being used for the ET final acceptance is severely cracked, uneven and overlays a large subgrade void caused by the unstable soil conditions at MAF. To correct this situation and prevent it's reoccurrence, it is necessary to replace the existing floor slab with pile

supported foundations and a new floor slab capable of supporting the weight of an ET and its transporter. A steel track will be installed in the new floor slab for securing access working platforms and an access from the existing third level control room to the operating ground level will be provided.

Flight grade air (clean/filtered compressed air) in lieu of gaseous nitrogen (GN_2) can be used for purging the intertank and Liquid Hydrogen (LH_2) tank prior to shipment from MAF. Such use will result in an estimated savings of $8,500 per ET and eliminate associated GN_2 safety hazards. In the case of GN_2 leak or spill the free GN_2 causes depletion of available oxygen thus creating a safety breathing hazard. This project provides the necessary compressor and filter equipment to supply the flight grade air.

IMPACT OF DELAY:

A delay in the rehabilitation of Building 420 will preclude the use of several cost effective procedures in the production operations of the ET. Without this project, it will be necessary to use temporary environmental shelters (tents) and associated equipment to provide the environment necessary to perform TPS closeouts. The use of these temporary tents has not been environmentally reliable and is an added recurring cost. The floor slab to be replaced is in extremely poor condition and delays in making the repairs will not allow this area to be used for final ET acceptance and preparation to ship. Deferral of the flight grade air equipment, would require the continuous use of more expensive and hazardous GN_2 for purging of the intertank and LH_2 tank.

PROJECT DESCRIPTION:

The existing HVAC system in two cells of Building 420 will be modified to provide the environmental conditions required to support TPS closeout application by installing a new 575-ton chiller, cooling tower, air handling units, duct work, piping and other associated mechanical and electrical systems. Caulking and sealing of openings in the existing cells will also be accomplished.

Floor repairs will be made to one of the existing cells, to include providing pile supported pathways and hard points to structurally accommodate a loaded ET transporter. Track supports for personnel access platform assemblies will also be installed in the new floor slab. A door and access platform from the existing third level control room to ground level will also be provided.

The flight grade air system includes the installation of two 500-SCFM air compressors, air dryer, expansion tank and associated electrical, mechanical and control systems.

PROJECT COST ESTIMATE:

This cost estimate is based on completed preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	2,785,000
Modification to environmental system	---	---	---	1,830,000
Mechanical systems	LS	---	---	(1,261,000)
Electrical systems	LS	---	---	(569,000)
Repair to cell floor	---	---	---	515,000
Architectural/structure	LS	---	---	(420.000)
Mechanical systems	LS	---	---	(48,000)
Electrical systems	LS	---	---	(47,000)
Flight grade air system	---	---	---	440,000
Architectural/structural	LS	---	---	(7,500)
Mechanical systems	LS	---	---	(316,000)
Electrical systems	LS	---	---	(116,500)
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				2,785,000

LIST OF RELATED GRAPHICS:

Figure 1 - MAF Location Plan
Figure 2 - Building 420 Site Plan

OTHER EOUIPMENT SUMMARY:

Special tooling and equipment (e.g., TPS closeout kits, leak check equipment and unique personnel work platforms) will be needed for initial operations. These will be funded from R&D sources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

CoF resources may be required in the future to provide for additional production related facilities to support the maximum ET production rate. These may include ET storage facilities, additional TPS cells and related supporting facilities.

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES
FOR EXTERNAL TANKS

SITE PLAN

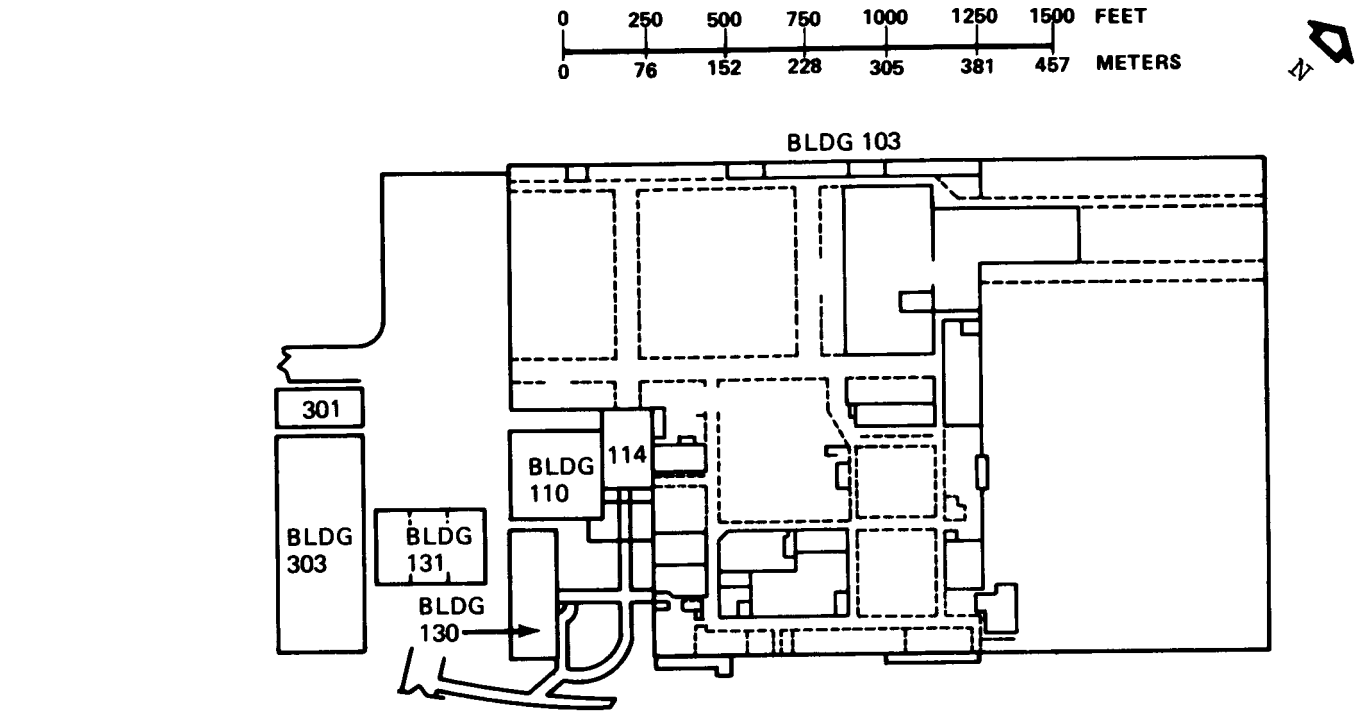
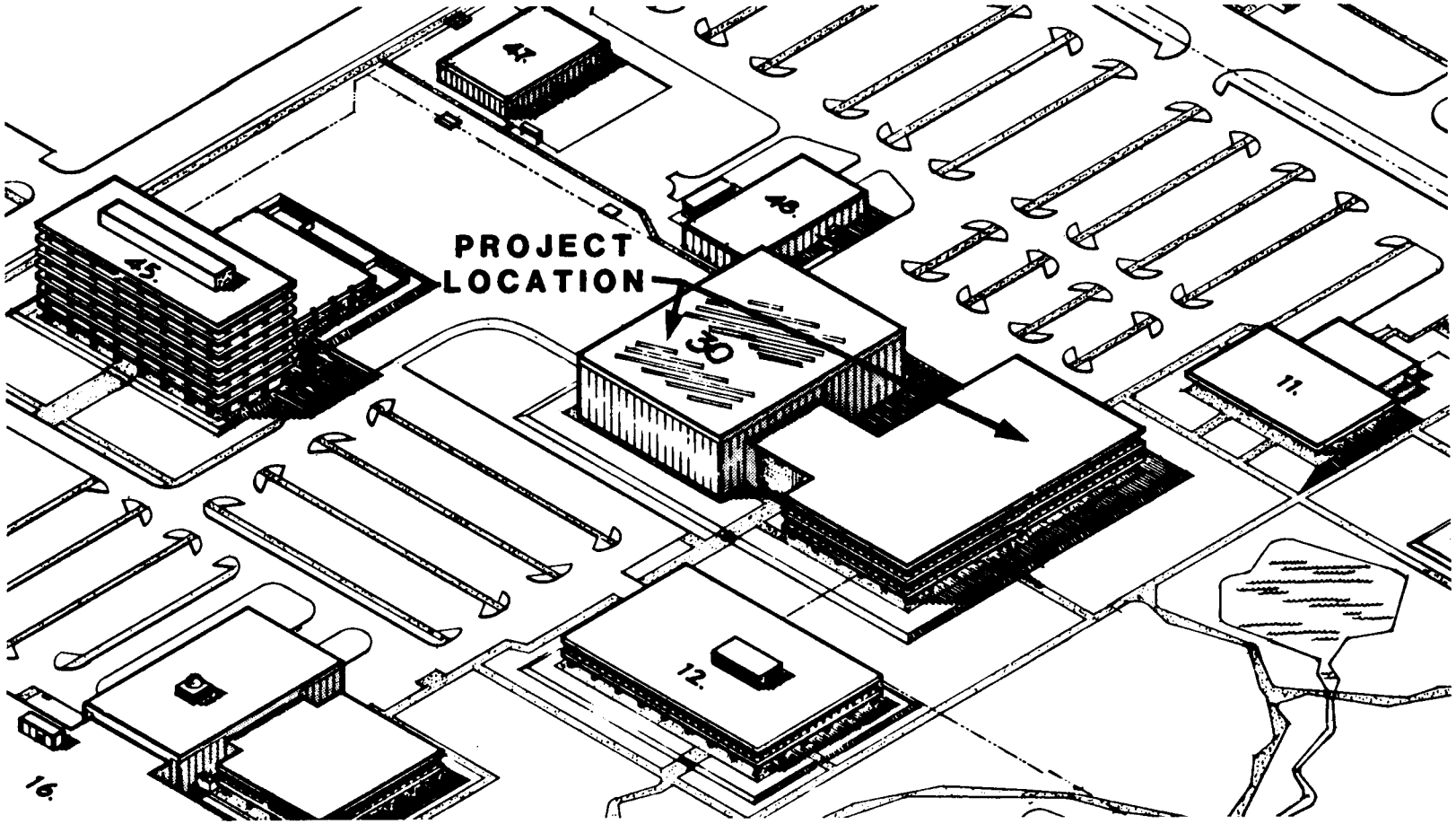


FIGURE 2

CF 10-25

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO BUILDING 30 FOR SHUTTLE OPERATIONS

LOCATION PLAN



(NOT TO SCALE)

FIGURE 1

PROJECT TITLE: Modifications to Building 30 for Shuttle Operations

INSTALLATION: Lyndon B. Johnson Space Center

FY 1982 CoF ESTIMATE: $650,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	161,100	1,704,000	1,865,100
Capitalized investment	N/A	9,598,666	9,598,666
Total	161,100	11,302,666	11,463,766

SUMMARY PURPOSE AND SCOPE:

This project provides modifications to the Administration Wing and the Mission Operations Wing (MOW) of Building 30, Mission Control Center at Johnson Space Center (JSC) (Figure 1) for support of Shuttle operations. Modifications to the Administration Wing include the reconfiguration of the third floor to house the Software Production activity which will provide the software development required by the higher flight rates during the Space Transportation System (STS) operations phase. Modifications to the Mission Operations Wing will reconfigure the second floor to provide a second flight control room and other support facilities to permit simultaneous control of more than one STS flight.

PROJECT JUSTIFICATION:

The Mission Control Center at JSC is a critical facility in the total STS operational plan. In this facility every flight will be monitored and controlled from lift-off until mission completion. After launch all aspects of each mission, as well as the flight itself, are controlled from this facility. To provide adequate control of simultaneous flights and multimission profiles, it is necessary that adequate capability for software development and a sufficient number of flight control rooms be provided.

The Software Development Laboratory, which is currently located in the Mission Operations Wing of Building 30, must be expanded from a configuration which supports singular software system development, integration, and verification into a facility capable of mass production of software systems required to support STS operations. The only feasible location large enough to accommodate joint NASA-DOD Shuttle software production activities is the third floor core area in the Administration Wing. Increasing flight rates during the STS operational phase will require the proposed Software Production Facility (SPF) to simultaneously manage up to 30 software systems in various stages of development. This expanded requirement necessitates an SPF capacity and size which is much greater than that of the present Software Development Laboratory. This project will provide the modifications that will accommodate a second computer for NASA operations to supplement the joint use NASA-DOD computer system installed under an earlier phase of work. This additional work will make the SPF fully operational.

The Mission Operations Wing of Building 30 was originally designed for the single mission capability required by the Apollo Program. This single mission capability is satisfactory during the early stages of the STS flight program. As the flight rate increases, a second dedicated flight control room must be provided on the second floor of the MOW and multipurpose support areas must be reconfigured to accommodate simultaneous support of STS flights. The existing facility configuration cannot support the flight schedule once the STS becomes operational.

IMPACT OF DELAY:

Existing functional areas of Building 30 are capable of supporting the early stages of STS operations, but as the program moves into the operational phase, shorter turn-around times will not permit orderly control of each mission with this limited capability. Delay of the Software Production Facility portion of this project will impact adversely on orderly mission training and flight schedules. Delay in providing a second flight control room will cause mission delays because a single flight control room will not be able to handle overlapping mission support requirements.

PROJECT DESCRIPTION:

This project will result in modifications to the third floor of the Administration Wing of Building 30 (Figure 2) to provide a Software Production Facility, and a reconfiguration of the second floor of the Mission Operations Wing (Figure 3) to provide a second flight control room.

The work in the Administration Wing will complete the reconfiguration of the third floor core area which was started with resources in FY 1981. The work continues modifications for the addition of a second computer system for the SPF. It includes reconfiguration of interior partitions and doors, installation of raised flooring, and minor changes to existing lighting as required to suit the reconfigured areas. Also included are modifications to electrical power, air-conditioning, and closed-loop water cooling systems required by the computer equipment. In addition, this project provides for construction of fire walls and modifications to fire detection and fire suppression systems to meet NASA fire safety standards.

This project also provides construction of a second flight control room and other modifications to reconfigure the multipurpose support rooms on the second floor of the MOW. It includes removal of existing partitions and doors and installation of new partitions, doors, raised flooring, and suspended ceiling. Also included are modifications to existing lighting, electrical power distribution, and air-conditioning systems. Necessary changes to the existing fire detection and suppression system will also be provided.

PROJECT COST ESTIMATE:

This cost estimate is based on design criteria and concepts.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	---
Modifications to administration wing	---	---	---	350,000
Software production laboratory	SF	6,800	22.06	(150,000)
Support utilities, mechanical room	LS	---	---	(200,000)
Modifications to mision operations wing	---	---	---	300,000
Structural/architectural	LS	---	---	(168,000)
Electrical	LS	---	---	(90,000)
Fire protection.	LS	---	---	(27,000)
Mechanical	LS	---	---	(15,000)
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				650,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Third Floor Plan (Administration Wind) Building 30
Figure 3 - Second Floor Plan (Mission Operations Wing) Building 30

OTHER EQUIPMENT SUMMARY:

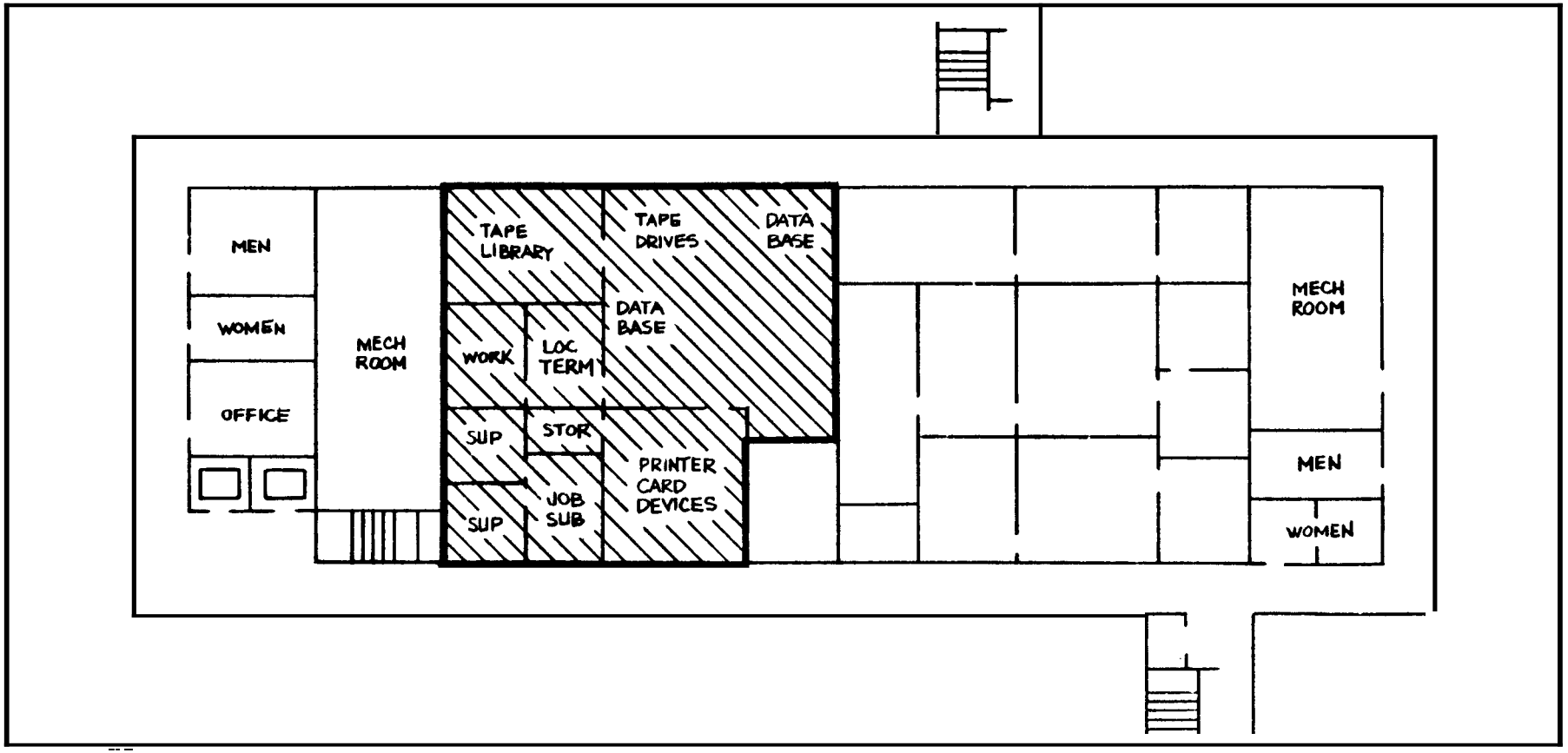
Software production equipment will be acquired with R&D funds through a lease/maintenance agreement during FY 1983-84 and final purchase in FY 1985 at a total cost of $8,000,000. The necessary flight control equipment for the 2nd control room will consist of existing R&D equipment valued at $16,000,000, and new equipment estimated to cost $10-11 million, funded from FY 1980-1983 R&D programs.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that CoF funds in the amount of $300,000 will the required for further modifications to the Mission Operations Wing in FY 1983 and 1984. These funds will be requested in the CoF Rehabilitation and Modifications program.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO BUILDING 30 FOR SHUTTLE OPERATIONS

THIRD FLOOR PLAN (ADMINISTRATION WING)



LEGEND :

AREA OF MODIFICATIONS

(NOT TO SCALE)

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FIGURE 2

CF 10-32

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1982 ESTIMATES
MODIFICATIONS TO BUILDING 30 FOR SHUTTLE OPERATIONS

SECOND FLOOR PLAN MISSION OPERATIONS (MOCR)

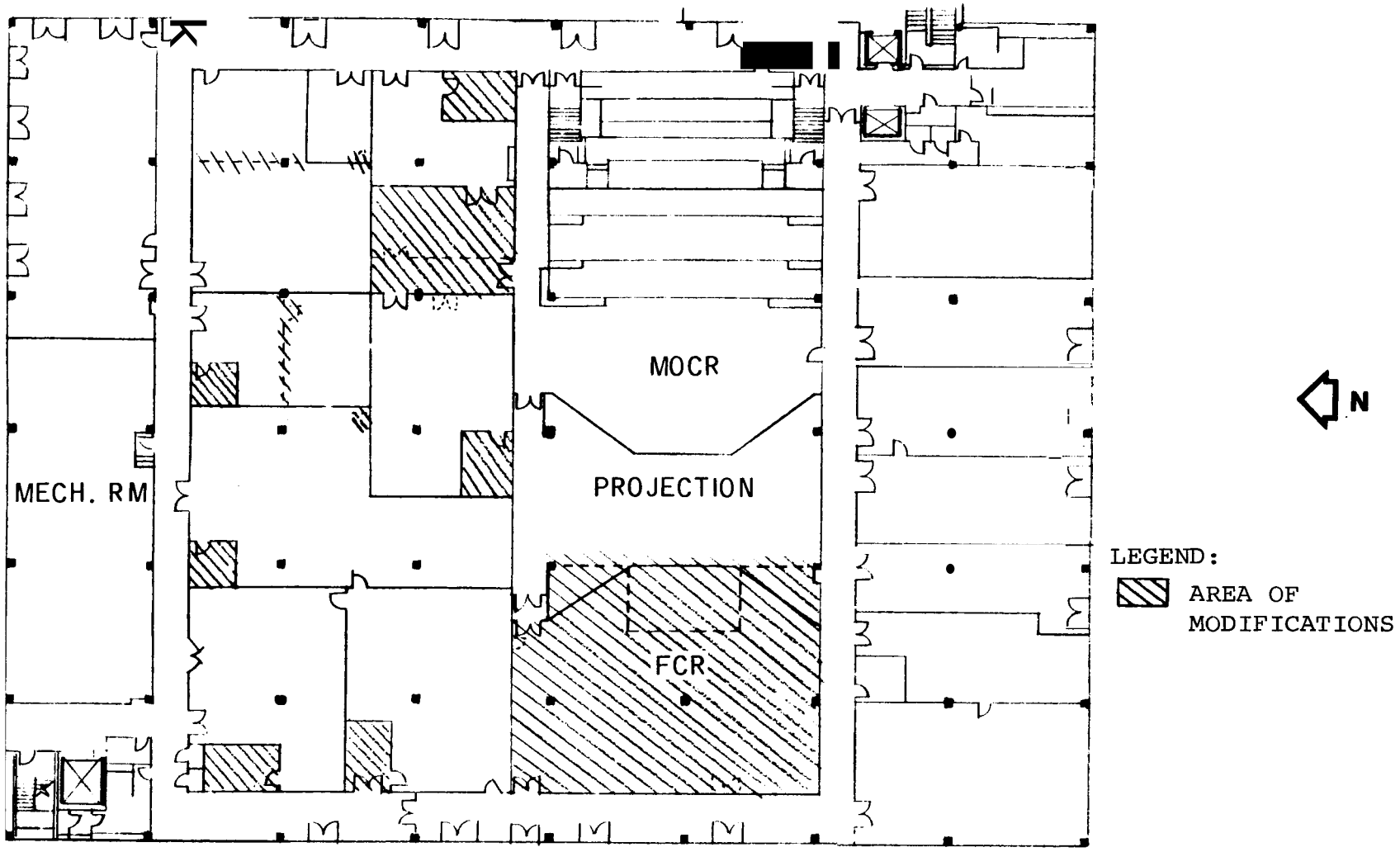

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FIGURE 3

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE: Minor Shuttle-Unique Projects

INSTALLATION: Various Locations

FY 1982 CoF ESTIMATE: $1,115,000

LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1981 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	872,000	*10,710,000	11,582,000
Capitalized investment	N/A	**1,565,000	1,565,000
Total	872,000	12,275,000	13,147,000

*CoF Minor Shuttle-Unique Projects
**R&D/R&PM Minor Shuttle-Unique Projects

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide minor rehabilitation , modification and construction of facilities necessary for support of the Space Shuttle Program at various NASA field installations. Included in this funding request are facility projects estimated to cost not in excess of $500,000 each. These projects respond

to unique requirements of the Space Shuttle Program and are needed to achieve initial operational capability or to meet the program milestones.

PROJECT JUSTIFICATION:

Space Shuttle development, assembly, and test requirements are being accomplished to a large extent in Government facilities at various NASA installations and industrial plants. Any major modifications or new construction required at these locations is described as a major project elsewhere in this budget request. This project includes only those Shuttle-unique facility rehabilitation, modification and construction projects estimated to cost not in excess of $500,000. Each item of work listed under "PROJECT DESCRIPTION" is necessary to support a specific Shuttle requirement, insure continued reliability, provide a safer environment, and/or improve the efficiency and economy of individual facilities supporting the Space Shuttle Program. It is recognized, however, that during project planning and implementation some rearrangement of priorities may be necessary. These changes will be accomplished within the available resources.

For clarity, full disclosure purposes, and better fiscal and technical control, all Space Shuttle facility costs for both major and these minor facilities projects, are summarized under "Space Shuttle Facilities-Various Locations". The cost of these minor projects are thus charged against the total Space Shuttle facilities commitment.

PROJECT DESCRIPTION:

The justification, description, and cost estimate for all elements of the Shuttle-Unique minor projects are listed below:

A.	Johnson Space Center (JSC).....	250,000
1.	Modifications for Guidance and Navigation Trainer, Building 35.....	250,000

This project supports the second phase of a three-phase R&D program to expand astronaut flight simulator training to keep pace with future increasing flight rates. The first phase provided new computer equipment for software package development to simulate specific missions. The second R&D phase will provide a new crew simulation training station which will be used for general astronaut training and segments of specific mission training. This phase is required to support flight rates in excessive of twelve per year. The third phase will provide R&D computer equipment for software development to support flight training simulation as the shuttle program moves into the operational phase. This minor facility project supports the installation of a full-up forward crew simulator (less forward visual)/crew training station with flight simulator computers and

provides for instructor mission controller training stations. Proposed work in Building 35 includes installation of raised computer flooring, installation of fire detection/suppression systems, rehabilitation and modification to existing primary/secondary electrical and HVAC systems, various structural modifications required to delineate work space and to attain required fire retardation/containment criteria.

It is anticipated that a future CoF budget request will be required to support the third R&D phase mentioned above. However, at this time a cost estimate has not been prepared.

B. Kennedy Space Center (KSC)..... 465,000

1. Modifications to High Bay 1 and High Bay 2, Vehicle Assembly Building (VAB)..... 465,000

After completion of the Shuttle facility modifications to the VAB, new programmatic requirements caused additional minor facility modifications to High Bays 3 and 4. These two high bays are needed for initial operations, with High Bay 4 supporting External Tank (ET) processing/staging and High Bay 3 the location for component integration on the mobile launch platform. This project provides these same modifications to High Bays 1 and 2, which will be needed to support two Orbiters in flow. There are approximately forty modifications to be made. The work in High Bay 1 includes providing for an Orbiter access clean room, and modifications to hydraulic hose supports, Orbiter environmental control system (ECS) ducts, and miscellaneous access platforms and handrails. The work in High Bay 2 includes providing an elevator platform at level 8, and modifications to the compressed air distribution system, modifying the ET purge gas ducts, and miscellaneous access platforms and handrails.

C. Marshall Space Flight Center/Michoud Assembly Facility (MSFC/MAF)..... 400,000

1. Modification of Building 103, Production Support and Maintenance Area..... 400,000

This modification is required to provide logistics support for the thermal protection system (TPS) activities performed in the Vertical Assembly Building (110) and the High Bay Addition (114). The current use of trailers, and remote offices and cleaning facilities is costly, time consuming, and will be an impediment to increasing production rates. This project provides for modification of an area 50 feet (15.2 meters) by 90 feet (27.4 meters) in Building 103 to provide a maintenance area and to accommodate forty-two production support workers. As part of this modification, two rooms for cleaning TPS application guns will be provided. Related fencing and security devices are also inoluded. This project was deferred from FY 1981 in order to accomplish work of higher priority.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

REPAIR

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	1.325. 000	CF 11–3
Dryden Flight Research Center	260. 000	CF 11–4
Goddard Space Flight Center	1.005. 000	CF 11–5
Jet Propulsion Laboratoray	1.435. 000	CF 11–6
Johnson Space Center	1.560. 000	CF 11–7
Kennedy Space Center	450. 000	CF 11–9
Langley Research Center	1.620. 000	CF 11–9
Lewis Research Center	1.365. 000	CF 11–11
Marshall Space Flight Center	1.550. 000	CF 11–13
Michoud Assembly Facility	1.745. 000	CF 11–14
National Space Technology Laboratories	1.055. 000	CF 11–16
Wallops Flight Center	965. 000	CF 11–17
Miscellaneous Projects less than $150. 000 each	665. 000	CF 11–18
Total	15.000. 000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE:	Repair of Facilities not in Excess of $500,000 Per Project
INSTALLATION:	Various Locations
	FY 1982 CoF ESTIMATE: $15,000,000

FY 1980: $12,000,000	FY 1981: $15,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

SUMMARY PURPOSE AND SCOPE:

These resources will provide for large repairs to facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in the request are those facility repair needs for FY 1982 that can be foreseen at the time of the submission of these estimates, and that are estimated not to exceed $500,000 per project. The thrust of this program is to provide a means to restore facilities or components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. It includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown. This work also includes major preventive measures which are normally accomplished on a cyclic schedule of greater than one year.

PROJECT JUSTIFICATION:

A major portion of the Agency's building inventory is in the 15 + year old bracket and increases in repair requirements are to be expected. Maintenance and repair costs for mechanical and electrical systems in a typical building are almost three times higher during the 16- to 30-year period of a building's life than they

are during the initial 15 years of beneficial occupancy. At about the 15-year point many electrical and mechanical components reach the end of their serviceable or economic life and should be replaced in the interest of long-term economy. Continued piecemeal repair of these components usually requires more resources in the long run than replacement after the end of the economic life of the original components. This condition is now being encountered at locations such as Goddard Space Flight Center (GSFC) and Johnson Space Center (JSC). The sheer age of other portions of the plant, such as at Langley Research Center (LaRC) and Lewis Research Center (LeRC), highlights the need for an aggressive repair program. Some 75 percent of the physical plant is in the 16 to 30-year old bracket.

The major thrust of this repair program as well as the rehabilitation and modification program is to preserve the Agency's $6.8 billion (September 30, 1980) physical plant. The major distinction between these classes of work is whether or not the intended work is to bring the facility and its components to a condition substantially equivalent to its designed capacity, efficiency and capabilities. If such is the case, the work is properly classed as repair. An analysis of each of the projects which follows indicates that this is the type of work which must be addressed and progressively accomplished. Unless this is done, resultant risks are increased, and future costs of the specific work will be greater. More importantly, there will be increased breakdown and costly emergency repair required.

This project includes only facility repair work having an estimated cost not in excess of $500,000. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facilitymaintenance and repair activities, or by related routine facility work efforts that are provided for in other than CoF estimates. Each repair project estimated to cost more than $500,000 is reflected elsewhere as a separate major CoF line item project.

PROJECT DESCRIPTION:

Proposed repair projects for FY 1982 totaling $15,000,000 are described under "PROJECT COST ESTIMATE". Only those projects estimated to cost less than $150,000 have not been individually described or identified by center. The total cost for these miscellaneous projects is $665,000. This program has been distilled from requests exceeding $22,500,000 for FY 1982 only and thus represents a modest request in relation to the backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are of the highest priority. Deferral of'this mission essential work would adversely impact the availability of critical facilities and program schedules.

During the course of the year, some rearrangement of priorities may be necessary. This may force a change in some of the items to be accomplished. Any such change, however, will be accomplished within available resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE".

a. Utility Systems	3,515,000
b. General Purpose Buildings	865,000
c. Technical Buildings/Structures	4,615,000
d. Pavements and Drainage	2,080,000
e. Building Exteriors and Roofs	3,925,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC)	1,325,000
1. Repair of 3.5-Foot Heater Dome	415,000

The pebble bed storage heater in the 3.5-foot Hypersonic Wind Tunnel is an essential component of the facility. It is used to heat dry, pressurized air. The air is heated to prevent liquefaction as it is expanded into the test section through nozzles rated at Mach 5 to Mach 14. Because the dome area, burner and outlet areas of the heater are subjected to severe cyclic fluctuations of temperature, pressure and flow rate, they are suffering progressive deterioration. This project will repair the refractory insulating brick in the dome, burner and outlet areas of the storage heater. The bricks will be fabricated and installed in place. This facility supports such programs as the Space Shuttle Thrust Augmentation Program, development testing of missiles and development of thermal protection systems.

2. Repair of Unitary Plan Wind Tunnel Subsystems	480,000

This project provides for the repair of components of three major subsystems of the Unitary Plan Wind Tunnel (UPWT). The pump discharge manifold at the cooling tower has been in operation since 1956. This system has developed leaks and must be replaced. The rotor shrouds of the three stage compressor for the 11-Foot Transonic Tunnel have exceeded their operational life and must be replaced now to avoid failure. The makeup air system has a series of water cooling coils and refrigerant coils that have been frequently repaired.

These coils will be replaced in order to insure reliable operation of the system. The UPWT is a highly utilized tunnel consisting of two supersonic and one transonic leg. All three legs are powered by a common set of drive motors. This facility supports numerous programs from Mach .7 to Mach 3.5.

3. Repair of Roofs in Various Buildings 270,000

This project provides for the repair of roofs on Buildings N-212, N-213, N-231, N-236, N-239A, N-239. The age of these roofs ranges from 16 to 30 years. Only minor repair work has been performed over the last 10 years. Consequently, large portions of the roofs have deteriorated to the extent that total roofing system removal and replacement with new roofing is necessary. Included in this project is the removal of the existing roof, and installation of two inches of insulation, new flashing gravel stops and a three layer mineral surfaced roof.

4. Repair of Roads..... 160,000

This project provides for the repair and application of a pavement overlay on Walcott Road and on the Perimeter Road. Walcott Road is 25-30 years old. Since initial paving, its surface has been slurried twice. The surface now has become checked and cracked to the point where rainwater has penetrated the surface and caused deterioration of the base material. A three-inch course of asphaltic concrete will be installed over the existing surface. The Perimeter Road consists of surplus fill with four inches of subbase material and an oil sealcoat. This surface has not held up well under traffic and consequently, requires constant repair. To make the road serviceable and avoid constant repair work, a new surface must be installed. This project will place a two inch course of asphaltic concrete over the existing surface.

B. Dryden Flight Research Center (DFRC) 260,000

1. Repair of Roof, Building 4800..... 260,000

This project replaces 72,100 square feet (6,689 square meters) of built up roofing on the Research and Development and Test Facility, Building 4800. The new roofing will provide for adequate run-off, thereby reducing the potential for leaks and deterioration. Most of the roof on this building is over 25 years old and requires continual costly maintenance to control the numerous leaks.

C. Goddard Space Flight Center (GSFC)..... 1,005,000

1. Repair of Transformers in Buildings 1, 2, 3 and 6..... 300,000

These resources provide for the repair of transformers in Building 1, 2, 3 and 6. Work includes the replacement of hazardous coolant fluid used in 10 transformers. The coolant, polychlorinated biphenyl (PCB), has been determined to be a carcinogen. An engineering study has indicated that coolant replacement is more cost effective than complete transformer replacement for these units. The PCB will be disposed of in an acceptable manner. These GSFC transformers are not considered hazardous at this time, but the potential exists for severe ecological damage should a leak develop or accidental damage occur. This project is part of a multi-year effort to replace all PCB fluid-filled transformers at GSFC.

2. Repair of HVAC System in the Data Interpretation Laboratory, Building 23.. 200,000

These resources provide for the repair of the HVAC system in the Data Interpretation Laboratory, Building 23. Work includes replacement of heat exchanger cooling coils in 10 air handling units with higher capacity coils. Existing lower capacity coils cause excessive chilled water to be used to maintain a minimally acceptable environment for the computing systems in this building. This excessive use of chilled water unbalances the Center-wide chilled water system and results in operational problems in buildings at greater distance from the central plant. This repair work must be accomplished at this time to provide adequate conditions in Building 23 to support computer and data processing operations, and to provide sufficient chilled water supply to other center facilities.

3. Repair of Roofs of General Purpose Facility, Building 4, and Applied Sciences Laboratory, Building 11..... 300,000

These resources provide for repair of approximately 24,000 square feet (2,230 square meters) of roof surfaces on Building 4 and approximately 20,000 square feet (1,800 square meters) on Building 11. The repairs to Building 4 include the installation of a new cold-applied roofing system, flashing and other related work. The work on Building 11 includes removing the deteriorated roofing and installing a 5-ply system with rigid insulation and a new fascia system. This project developed from a survey of the roof conditions at the Center and is a portion of a planned program for corrective action. The roofs are nearly 20 years old and in need of repair. Deterioration of the roofs has resulted in frequent leaks and threatens research equipment within the buildings.

4. Repair Paved Surfaces..... 205,000

These resources provide for the second portion of work in a planned 3-year repair program to improve the paved surface areas of the center. This work includes resurfacing, with 2.5 inches (6.4 centimeters) of asphalt paving, approximately 25,000 square feet (2,300 square meters) of parking lots serving Buildings 6 and 23. Drainage, curbing, patching, and related repair work will also be included. Originally constructed in the early 1960's, the parking lots have deteriorated due to heavy usage. The severity of the past several winters has caused numerous pot holes and depressions to develop resulting in accelerated deterioration and failing surface conditions. Further roadway deterioration, with attendant rise in costs, will occur if this work is delayed.

D. Jet Propulsion Laboratory (JPL)..... 1,435,000

1. Repair Exterior Physical Sciences Laboratory, Building 183..... 385,000

These resources provide for the repair of the exterior walls of the Physical Sciences Laboratory, Building 183, at JPL. Work includes the removal and replacement of some 400 cracked and damaged stucco exterior panels of the building. Also included is the repair of some 70 prefinished metal exterior panels and 80 metal louvers. An old nine-story metal frame test tower, which is deteriorating and no longer needed, will be removed from the south wall. Major cracks occurred during a 1971 earthquake. The cracks along with deteriorating caulking, allow water to penetrate into the building. The prefinished panels and metal louvers leak. Old built-up layers of paint on the exterior panels have deteriorated and are flaking and pealing causing unsightly conditions and permitting moisture damage to the facility. This repair work is urgently needed at this time.

2. Repair Exterior, Material Service Building 171 and Central Engineering Building 180..... 480,000

These resources provide for the repair to the exterior surfaces of the Materials Services Building 171 and the Central Engineering Building 180 at JPL. Work includes preparation and cleaning, grouting, caulking, painting, and general renewal of approximately 91,000-square feet (8,454 square meters) of exterior wall surfaces. This repair work is required at this time to maintain the exterior integrity of the buildings, repair surface defects generated as a result of the 1971 earthquake, and to prevent rainwater leakage. These buildings are major facilities and of such value that the exterior repair work must be accomplished.

3. Repair HVAC Equipment, Spacecraft Development Building (233)... 400,000

These resources provide for repair of the HVAC equipment in the Spacecraft Development Building 233. Work includes the replacement of two old boilers with a new dual fuel low pressure boiler and related repairs to the hot water distribution system. The centrifugal chillers and the air distribution system will be repaired. Inoperable HVAC controls will be replaced with new controls. The HVAC in Building 233 is 18 years old and is in need of extensive repairs. Repairs to the hot water and air distribution systems will result in reliable and energy efficient operation. The new controls and the other repair work to the HVAC system will provide satisfactory environmental conditions and savings of electrical energy.

4. Repair Storm Drain Systems..... 170,000

These resources provide for the most urgently required repairs to on-site storm drainage at JPL. Work includes the replacement of deteriorated corrugated metal trunk lines with reinforced concrete pipe. This involves the removal of the old pipe, connections to existing catch basins, manholes, branch lines and rerouting some new lines. Included is the replacement of approximately 1,300 liner feet (396 meters) of deteriorated open channel with a concrete open channel. JPL is located on a slope starting at the base of foothills to the north and descending southeasterly to the Arroyo Seco natural drainway. The foothill runoff is substantial and constricted by canyons to a high velocity flow. The runoff carries large amounts of sand, rocks and debris. The combination of sand, rocks, and water at high velocity has scoured the 25-year-old corrugated metal piping. Failure of these lines would cause damaging flooding of several acres and many buildings.

E. Johnson Space Center (JSC) 1,560,000

1. Repair of Heating, Ventilating and Air-conditioning Systems, Various Buildings..... 400,000

This project is part of an ongoing program to repair heating and cooling equipment in various buildings at JSC. This includes the repair/replacement of air handler structures, compressors, condensers, controls, valves, pumps, condensate units, and fan/scroll assemblies. Tasks such as coil cleaning, damper and duct repair, suspension replacement, piping replacement and other general repair work will also be performed. The work will take place in Buildings 10, 13, 15, 29, 33, 36, and the 300 area. Included is the repair and/or replacement of 59 chilled water air handlers and ancillary equipment, the replacement of 10 direct expansion air handlers, the replacement of four condensate return units, the repair of two blending stations, and the repair of two steam stations. This work is necessary because age, high humidity conditions, and salt/chemical content of the air in this region have accelerated the deterioration of coils, fans, and casings of air handling units. The various heating and cooling system components are also approaching the end of their normal life expectancy.

2. Repair of Utility Generation and Distribution Systems, Building 24 Complex..... 250,000

This project is part of an ongoing program to repair various components of JSC's primary utility generation and distribution systems located in the Central Heating and Cooling Plant and the adjacent cooling tower and utility tunnel system. Work will be performed on steam and chilled water systems, and will include the repair/replacement of 15 valves, a boiler, several pumps, a chiller, expansion joints, and other similar work. The project is necessary to keep abreast of the repair/replacement of components of the systems on a planned cyclic basis. This will help to preclude serious outages by scheduling the work at the end of the planned lifetime of each component, but before failure occurs causing costly breakdown maintenance. Since most of the components are relatively long lead procurements, failures can result in long term outages or operations without backup capability for critical operations and buildings. This project will assure the continuing reliability, efficiency and safety of the systems.

3. Repair of Roofs, NASA Industrial Plant, Downey, California..... 415,000

This project is part of a multiyear program for the repair of roofs at the NASA Industrial Plant, Downey, California. This phase provides for the repair of approximately 215,000 square feet (19,974 square meters) of roofing on Buildings 001, 287, and 290. Flashing, valleys, and gutters will also be replaced as required. The sawtooth portion of Building 001 roof was built in increments between 1928 and 1941 and consists of wood, steel, and transite decking. The roofs on Building 287 and 290 will be 19 years old in 1982. These structures have a history of leaks which have required extensive repairs and patching in recent years. Delay in reroofing could cause damage to the buildings' structures, to the interiors, and to hardware and test equipment located therein.

4. Repair of Roofs, Buildings 32 and 49..... 240,000

This project includes repairs to the roofs of the Space Environment Simulation Laboratory, Building 32 and the Vibration and Acoustic Test Facility, Building 49. Approximately 60,000 square feet (5,574 square meters) of 17-year-old roofing, 5,000 square feet (464 square meters) of insulation board, and 1,000 linear feet (305 meters) of perimeter flashing will be replaced. Approximately 40 roof vents will be installed in areas containing moisture where deterioration has not proceeded to the point where roof replacement is necessary. The increasing rate of roof deterioration is exceeding local maintenance capability. This project is needed to preclude damage to building structures, as well as interior ceiling panels, electrical panels, and sensitive equipment and electronics.

5. Repair of the Water System.. 255,000

This project is the first phase of a two-year program to repair portions of the JSC water system. This work includes repair and/or replacement of shutoff valves in the main distribution lines, and the cathodic protection of two ground water storage tanks and two elevated storage tanks. Included is the painting of the exterior and interior surfaces of these storage tanks. Approximately 30 shutoff valves in the main line and at fire hydrants will be replaced. Work on the cathodic protection system at the water tanks includes repair or replacement of the rectifier units and the anode ground bed system at each tank. The elevated water tanks to be painted are of the spherical type. One elevated tank is approximately 163 feet (49.6 meters) high and has a capacity of 250,000 gallons (946,358 liters). The other tank, located in the Thermochemical Test Area, is approximately 131 feet (39.9 meters) high and has a capacity of 100.000 gallons (378,543 liters). The ground storage tanks to be painted have a capacity of 1,000,000gallons (3,785,430 liters) and 600,000 gallons (2,271,258 liters) each. This project is required to assure a continuous supply of potable and industrial water. The system is beginning to deteriorate from age, soil conditions, and water chemical compositions.

F. Kennedy Space Center (KSC)..... 450,000

1. Repair North Bound Lanes, Kennedy Parkway..... 450,000

These resources provide for the repair and resurfacing of approximately 9 miles (14.4 kilometers) of Kennedy Parkway, from the intersection with NASA Parkway to Wilson Corner, north of the VAB. This part of Kennedy Parkway is the main traffic artery between the KSC Industrial Area and the LC–39 area. The work includes filling pot holes, applying a tack coat of asphalt cement, laying a one-half inch (1.25 centimeter) leveling course of asphaltic concrete, laying a final one-inch (2.5 centimeter) surface course of asphaltic concrete, and restriping the roadway. Repair is needed now due to deterioration since the last resurfacing in 1963. Failure to perform this repair will result in eventual unsafe driving conditions and extensive damage to the underlying subcourse strata.

G. Langley Research Center (LaRC)..... 1,620,000

1. Repair of Roofs, Various Buildings..... 385,000

These resources provide for repair of 68,000 square feet (6,300 square meters) of roofs on Buildings 1219 (east wing), 1220 (hangar), 1232A, 1270, and 1284. The work includes complete removal of the old roofing and installation of new roofing systems. The roof decking will be repaired and roof drainage improvements will be made where necessary. The roofs on these buildings, which were built between 1945 and 1964, have deteriorated and continual repair is required. Water leakage has damaged roof decks and building interiors.

This work must be accomplished now to avoid major replacement of roof decks and further damage to the building interiors, and to reduce roof maintenance requirements.

2. Repair of Air-conditioning, Building 1192C 195,000

These resources provide for repair of the air-conditioning system in the Projects Directorate Office, Building 1192C. A new 60-ton (215 kilowatt) air-cooled condensing unit will replace the present unreliable equipment consisting of one 60-ton (215 kilowatt) air-cooled condensing unit and three of four 10-ton (36 kilowatt) roof top air-conditioners. The new unit will be connected to the existing air handling unit and variable air-volume system. Deteriorated acoustical ceiling tiles and obsolete light fixtures also will be replaced. One of the 10-ton (36-kilowatt) roof top air-conditioners will be retained for supplementing the new system during high heat load conditions in this technical office building.

3. Repair of Secondary Unit Substations, Various Buildings 215,000

This project replaces the electrical unit substations at Buildings 1221, 1222, and 1232A. Unit substations provide secondary 120 volt, 208 volt, and 480 volt electrical power from the incoming 2,300 volt power. These substations are over 20 years old and have worn and obsolete components; replacement parts are becoming unavailable. Steel bases and supports for electrical equipment are severely rusted. The electrical safety of these substations is less than acceptable by today's standards because of exposed wiring and components. Included is the replacement of the existing unit substations with totally metal enclosed units containing transformers, breakers and fused interrupter switches. This work will restore the reliability and maintainability of unit substation equipment and enhance safety.

4. Repair of West Area Potable Water Piping 370,000

This project replaces 6-inch (15-centimeter) and 8-inch (20-centimeter) cast-iron water mains in the LaRC West Area. Existing piping has been in service for approximately 30 years. The piping is extremely corroded. Potable water analyses indicate occasional levels of turbidity, color, manganese, and iron that are not in conformance with established standards. Included is the replacement of 5,500 linear feet (1,700 meters) of cast-iron pipe with 8-inch (20-centimeter) plastic pipe. These mains are located along Moffett Road from Ames Road to Building 1265, through the warehouse area to Building 1206; along Building 1247E, perpendicular to Moffett Road between Buildings 1247 and 1221 to Ames Road; and along Taylor Road from Building 1213 to Building 1148.

5. Repair of 10,000 cubic feet per minute Compressor and D-1 Motor, Building 640.. 300,000

This project provides for repairs to the 10,000 cubic feet per minute (cfm) (283 cubic meters per minute) compressor and the D-1 motor of the 8-Foot Transonic Pressure Tunnel, Building 640. Repairs to the compressor include disassembly, inspection and balance of the rotor, replacement of the guides and actuators, baffles, shoes, thrust plate, oil pumps, bearings and seals. Repairs to the D-1 motor include removal of the d.c. motor armature, replacement of existing windings and risers. This tunnel is the prime workhorse facility for conducting transonic aerodynamic research. A major R&D effort is planned in late FY 1982 for the Aircraft Energy Efficiency (ACEE) Program. In order to support the ACEE Program these repairs must be done prior to late FY 1982. During the next major shutdown these repairs will be performed.

6. Repair of West Area Pavement... 155,000

This project provides for the repair of approximately 20,000 square yards (16,000 square meters) of bituminous pavement in the LaRC West Area. The work includes 1.5 - 2.0 inches of bituminous overlay on prepared paved areas. This preparation includes repair of cracks, curbs, gutters, joints and hales as well as the application of a membrane to retard cracking of the new overlay. The areas to be repaired include portions of Ames Road, Taylor Road, Stratton Road, and the Building 1244 Annex apron and the adjacent Lindbergh Road. These repairs are required because concrete and bituminous pavements are deteriorating due to water penetration and freezing weather, as well as buckling on very hot days. This work will eliminate traffic road hazards and preserve the existing pavement and subbase.

H. Lewis Research Center (LeRC). 1,365,000

1. Repair 138 kv and 34.5 kv Oil Circuit Breakers, Various Substations..... 450,000

This project will provide for electrical repairs at three substations. At Substation A, all high voltage bushings in five 34.5 kv, 1,200 ampere oil circuit breakers and two 138 kv oil circuit breakers will be replaced. At Substation G, all the high voltage bushings in four 34.5 kv, 1200 ampere and three 34.5 kv, 2000 ampere oil circuit breakers will be replaced. At Substation K, all the high voltage bushings in four 34.5 kv, 2,000 ampere oil circuit breakers will be replaced. The circuit breakers included in this project provide essential switching and fault protection capabilities for the LeRC power distribution system. Lewis has experienced several failures of the bushings in the 34.5 kv breakers, and an on-going testing program indicates general deterioration of these bushings. Prompt repair will preclude the need for more extensive repair or replacement of the circuit breakers. The two 138 kv circuit breakers are 40 years old and replacement parts are not available. These breakers, because of their age, do not provide equivalent system protection to that provided by modern breakers.

2. Repair of Propulsion Systems Laboratory Exhaust Collector (125)..... 425,000

This project replaces the exhaust collector located in Test Chamber Number 4 of the Propulsion Systems Laboratory (PSL) Engine Test Building 125. The work includes necessary demolition and removal of the existing collector components, and the fabrication and installation of the new modular collector and bulkhead assembly. The collector and bulkhead separates the test chamber from the exhaust tunnel, preventing recirculation of exhaust gas into the test chamber. Features of the new collector design are directed to resolve problems of temperature, vibration, and recirculation. The assembly will be of modular bolted construction. The new design will incorporate water-cooled shields protecting bolted connections. A new hydraulic damper system will be provided on the collector inlet tube to control present vibration problems. Modular construction is planned to reduce fabrication costs and to facilitate future maintenance and repair work. The collector will be designed to handle a 250-pound (113.5 Kilograms) per second exhaust gas flow at 2,500°F (1370°C) and 9 pounds per square inch (6.2 Newtons per square centimeter) pressure. All major components exposed to exhaust gas flows will be water-cooled to minimize the corrosive effects of excessive temperatures. This work is needed to replace the deteriorated existing collector which has been exposed to severe service of large afterburning engines with their characteristically high exhaust temperatures and vibration levels.

3. Repair of the Steam Condensate Piping, Various Buildings..... 310,000

These resources provide for the repair of steam condensate piping, valves, traps, and condensate pumps in the carpenter shop area of Building 15; the equipment area of Building 8; the High Energy Fuel Laboratory of Building 51; and the Propulsion System Laboratory Shop and Access Buildings 65 and 66. This mechanical equipment has been in service for over 25 years. Although the traps and strainers have been replaced as required over the years, the complete system is now in need of replacement because of extensive corrosion and plugging.

4. Repairs of Roofs on Various Buildings..... 180,000

This project repairs approximately 20,400 square feet (1,900 square meters) of roof on the Engine Research Building's Northwest Wing, Building 37 and the southwest side of the Engine Research Building 5. The work includes major repairs to these roofs and will provide for additional insulation to reduce energy consumption. Equipment that is no longer in service will be removed from these roofs and the remaining roof penetrations will also be brought up to current standards. Unnecessary penetrations will be removed wherever possible. Roof surfaces exposed to pedestrian traffic will be protected with roof walkways. The roofs on these buildings are over 20 years old and require extensive maintenance to prevent water from damaging the building structure and equipment. Normal weathering, deterioration, and pedestrian traffic have reduced the integrity of these roofs to the point that major repairs are necessary now.

I. **Marshall** Space Flight Center (MSFC)..... 1,550,000

1. Repair Roofs, Various Buildings..... 435,000

These resources provide for the repair of roofs on twenty (20) buildings at MSFC. The work is required to repair blistering, soft spots, drying-out and alligatoring conditions. The roofs have exceeded the normal life in this area of 15 years. The project includes replacing roof covering, insulation and damaged flashings, and resaturating with a bituminous material to a firm smooth finish. Total area of roofing to be repaired is 230,000 square feet (21,400 square meters). These roof repairs are essential to protect facility capability and to remove the threat of unscheduled interruption to R&D operations. Accomplishment of this project will prevent possible damage to structures, interiors and building contents.

2. Repair Exterior Surfaces, Various Buildings..... 460,000

These resources provide for the exterior painting and repair of walls and other exterior surfaces of 13 buildings and structures with a total exterior area of 576,400 square feet (53,600 square meters). The work includes surface preparation, replacement of exterior surfaces where necessary, and application of an appropriate protective coating. Priority has been given to those facilities identified through field investigations. Buildings and structures included in this project are 4467, 4572, 4610, 4619, 4638, 4639, 4640, 4645, 4646 4659, 4666, 4670, and 4708. This project is required to protect selected buildings against the cumulative damaging effects of deterioration and to preserve the structural integrity and facility capability for continued operation.

3. Repair Chillers 1 and 2, Building 902, Slidell Computer Complex..... 170,000

These resources provide for the procurement and installation of two 200-ton centrifugal water chillers to replace the obsolete equipment presently located in Building 902. The project also provides for the associated piping and electrical modifications to accommodate the new chillers. The existing chillers have been in continuous service since the computer complex started operations, and are approaching their 20-year life expectancy. The continuous operation of the computers housed in Building 902 are critical to many NASA operations and programs. They are very sensitive to environmental conditions and are especially subject to damage by rapid change in ambient temperature and humidity. Maintenance of environmental conditions is necessary to prevent damage to the computers which would directly impact External Tank and Space Shuttle Propulsion Programs, **as** well as many other programs.

4. Repair Water Line, NASA Industrial Plant, Santa Susana, California 485,000

These resources provide for repair of the underground 1,500-foot (450 meter) long, 24-inch (61 centimeter) fire and water recovery pipeline serving the Santa Susana NASA Industrial Plant A-3 test stand area. The method of repair will be determined during design development and will consist of interior pipe reaming followed by either lining of the pipeline interior, or use of epoxy coated wrapping. Space Shuttle Main Engine (SSME) testing at Santa Susana is planned through 1985. Repairs on the above ground lines is on an as required basis, but undetected leaks in the underground piping could result in severe erosion of the test areas and test stand foundation, and loss of this unique SSME testing capability.

J. Michoud Assembly Facility (MAF) 1,745,000

1. Repair of 625-Ton Chiller for Building 350 200,000

This project replaces one of three 625-ton electrically-driven centrifugal chillers, including piping, and reconditioning of the existing worn-out starter, controls and switchgear. The existing chiller, which was installed in 1964, serves Engineering Building 350. During peak loading, three chillers are needed. Two of the three chillers were replaced recently as an emergency project because of major failures. Completion of this project will replace the remaining chiller, which has also reached the end of its useful life.

2. Repair Steam Supply System, Building 110 250,000

This project repairs the steam supply system serving the Vertical Assembly Building 110. Work includes replacement and insulation of approximately one-third of the couplings/flanges comprising the 200-pound steam system serving this facility. The VAB steam distribution system, installed in 1963, was inactive between 1970-1974. It is unreliable and cannot provide the critical environmental conditions required for application of the thermal protection system on the External Tanks.

3. Repair Roof, Building 420 450,000

This project includes the removal and replacement of roofing and insulation on the External Tank Final Acceptance/Preparation to Ship Facility (Building 420). Repair will be made to the flashing, expansion joint covers, pitch pockets, and the roof drainage system to prevent water ponding on the roof. The roof is in very poor condition and stopgap repair will no longer prevent damage to the building and its contents. The last major repair of this roof was accomplished in 1965.

4. Repair Sewer Lift Station 190,000

This project repairs 16 sewage lift-stations by replacing various pumps, valves, and controls to assure continuous operations. Most of these lift-stations were installed in 1943 and require extensive overhaul because of age and normal wear and tear. A failure of any one of these lift stations could cause sewage to back up, resulting in unacceptable health hazards and the probable cessation of operations in one or more buildings dedicated to external tank manufacturing.

5. Repair MAF Railroad Track..... 250,000

This project provides for rehabilitation of approximately 3,248 linear feet (990 meters) of MAF's railroad tracks, including portions of the main track and eight spur tracks which were installed in 1943. Specific work includes: reestablishing the proper line and grade: replacing damaged rails, cross ties and miscellaneous hardware: removing abandoned switchgear: replacing deteriorated/missing bumpers and wheel stops: and cleaning and adjusting all switches. Subgrade settlement has produced depressions in the ballast below the cross ties, thus reducing the system's bearing capacity, and causing track misalignment. Approximately 95% of the cross ties have deteriorated and require replacement. These rails are used in the delivery of external tank (ET) production materials, as well as diesel fuel for firing boilers at the main/secondary power Plants. A disruption in rail service would have serious impact upon ET production.

6. Repair Roadways and Parking Lot..... 210,000

This project provides for repair of parking areas and consists of preparing/overlaying approximately 22,250 square yards (18,600 square meters) of parking areas with 1 1/2 inch bituminous asphaltic concrete. All overlaid surfaces are to receive a prime coat and a slurry seal coat of sand/asphalt. Surfaces included in this project are parking lot **"K"** and the parking area south of Building 351. Unstable soil conditions at MAF result in settlement, ponding of water, pits and rolls in the parking areas which are dangerous and contribute to further roadway deterioration. Increased occupancy of Building 350 will increase utilization of the adjacent parking areas thus accelerating the settlement/deterioration process.

7. Repair Underground Fire Water Piping, Phase II..... 195,000

This project provides further repairs (Phase 11) to MAF's underground fire water piping, which was originally installed in 1943. Phase I consisted of repair of approximately 12,700 linear feet (3,871 meters) of the underground network, while this phase will cover approximately 5,500 linear feet (1,657 meters). The fire protection system consists of 8, 10, 12, and 16-inch diameter steel pipe with flexible couplings and a minimum ground cover of 2.5 feet. Pipe laid under railroad tracks is encased in the 12-inch-inside-diameter wood stave pipe. The project includes renewing and rebolting pipe, and repairing concrete thrust blocks at the intersections/corners of the underground loop main. Numerous leaks have been repaired over the past several years. With the exception of Buildings 320, 350 and 404, all buildings at MAF are protected by this system. Delay of this project could result in extensive damage and/or loss of life should this system fail during a fire.

K. National Space Technology Laboratory (NSTL) 1,055,000

1. Repair of High Pressure Gas System Components 300,000

These resources provide for continuation of a multiyear plan to remove, replace, repair and recertify distribution components in critical high pressure gas systems within the Shuttle Test Complex, cross country support systems, and base facilities. Prior year efforts provided for replacement of components in the most active gas systems as well as those components requiring the highest frequency of maintenance. This project installs approximately sixty (60) additional relief valves and thirty-three (33) hand valves which have been in service since 1965. Replacement or repair parts are no longer available to support continued component maintenance, as many of the orignial manufacturers and suppliers are no longer in business. Continued reliability of the gas systems which support Space Shuttle Main Engine (SSME) testing activities require the replacement of these obsolete components with new components capable of being readily serviced.

2. Repair of Marine Docks..... 270,000

These resources will provide for the repair and/or replacement of the deteriorated parts of the NSTL docks which have been in service since 1965. These docks constitute an integral part of the canal service system that supports propellant and other barge movement required by the Space Shuttle test program. The original dock, which was built with used, untreated timbers, is rotting and is termite infested. It requires major rework to prevent further deterioration and to preclude delays in shuttle testing. New timbers will be treated by a method that is compatible with liquid oxygen.

3. Repair of Lower Miter Gate, NSTL Navigation Lock..... 485,000

These resources provide for the repair of the lower miter gate of the NSTL Navigation Lock. The repair will include dewatering the lock in order to repair or replace needed underwater component hardware such as the gate side and bottom seals, timber fenders, cathodic protection system, gate pintles, lubrication piping, and rehabilitation of the lower gate machinery. The dewatering process will require the placement of structures in the canal downstream of lower miter gates in order to barricade water flow.

A recent inspection by the Corps of Engineers (Mobile District) recommended specific maintenance actions to correct deficiencies. The report further recommended dewatering, inspection and repairs of other underwater portions of the lock. Approximately fifty percent (50%) of these recommended underwater repairs (for the upper miter gates) are being accomplished with FY 1980 CoF resources. This project provides for the balance of the repairs. Deferral of these repairs could result in an operational failure, which would impair delivery of cryogenics which support NSTL mission requirements, and materials which support other agency requirements.

L. Wallops Flight Center (-C)..... 965,000

1. Repair of Machine Shop Heating System, Building F-10..... 200,000

These resources provide for replacement of four deteriorated steam fed heaters, the air distribution system in the machine shop area of Building F-10 and ceiling insulation. This shop area was originally aircraft hangar space. Now a machine shop, it is used for sounding rocket fabrication and also supports aircraft and launch range operations. The replacement equipment included in this project will be installed to more efficiently heat the machine shop as well as provide more uniform temperature distribution.

2. Repair of Roofs, Various Buildings... 285,000

This project replaces roofs on three buildings. Included is the entire roof of Building E-104 (7,000 square feet or 650 square meters), the upper portion of the roof on aircraft hangar Building D-1, (27,000 square feet or 2,500 square meters), and the west wing roof of Building N-159 (11,000 square feet or 1,000 square meters). Building E-104 houses the NASA Management Education and Training Center, Building D-1 is an aircraft operations hangar, and Building N-159 is an environmental test laboratory. These roofs are over 20 years old and have deteriorated to the point that replacement is necessary to prevent interior building damage and to reduce "patchwork" maintenance.

3. Repair of Airfield **Pavements**..... 480,000

This project provides for the repair of deteriorated airfield pavements at Wallops Flight Center. Repair of asphalt pavement at the surface transitions to Portland cement concrete (PCC) will be required at two locations on runway 4-22 and four locations on runway 10-28. Spalled PCC surfaces and joints on various taxiways and parking aprons also will be repaired. These repairs are necessary at this time to maintain acceptable surface quality and to avoid serious debris damage to conventional and research aircraft. Repairs also are required to prevent further pavement deterioration which would lead to more extensive and costly future repairs. This scope of work was selected on the basis of highest priority requirements to insure safe aircraft operations, or as the most cost effective work to prevent more costly future repairs. It is anticipated that future projects will be necessary to repair additional segments of the runways and taxiways.

MISCELLANEOUS PROJECTS LESS THAN $150,000 EACH..... 665,000

TOTAL..... 15,000,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated $14 million to $17 million each year will be required for the continuation of this repair program.

REHABILITATION AND MODIFICATION OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

REHABILITATION AND MODIFICATION

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	1.775. 000	CF 12–3
Dryden Flight Research Center	1.125. 000	CF 12–5
Goddard Space Flight Center	1.505. 000	CF 12–6
Jet Propulsion Laboratoray	1.910. 000	CF 12–7
Johnson Space Center	1.795. 000	CF 12–9
Kennedy Space Center	1.205. 000	CF 12–12
Langley Research Center	1.795. 000	CF 12–13
Lewis Research Center	1.910. 000	CF 12–14
Marshall Space Flight Center	2.585. 000	CF 12–16
Michoud Assembly Facility	980. 000	CF 12–19
National Space Technology Laboratories	395. 000	CF 12–20
Wallops Flight Center	830,000	CF 12–21
Various Locations	1.095. 000	CF 12–22
Miscellaneous Projects less than $150.000 each	1.095. 000	CF 12–23
Total	20.000. 000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 COST ESTIMATES

PROJECT TITLE:	Rehabilitation and Modification of Facilities not in Excess of $500,000 per Project
INSTALLATION:	Various Locations
	FY 1982 CoF ESTIMATE: $20,000,000
FY 1980: $19,790,000	FY 1981: $20,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

SUMMARY PURPOSE AND SCOPE:

These resources will provide for the rehabilitation and modification of facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in this request are those facility rehabilitation and modification needs for FY 1982 that can be foreseen at the time of the submission of these estimates, and that are estimated not to exceed $500,000 per project. The purpose of this program is to restore or enhance the condition of a facility so that it might more effectively accomplish its designated purpose or increase its functional capability.

As part of the rehabilitation and modification work, the Agency continues to emphasize the identification of projects that relate directly to the conservation of energy at the various field installations. The energy related projects constitute $3,015,000 of the total $20,000,000 requested for FY 1982 and include both institutional and programmatic energy reduction initiatives. Each initiative has a simple payback period of five years or less.

PROJECT JUSTIFICATION:

At its initial cost, the existing NASA physical plant totals about $6.8 billion (September 30, 1980). A continuing program of rehabilitation and modificaiton of these facilities is required to:

a. Protect the capital investment in these facilities by minimizing the cumulative effects of wear and deterioration.

b. Ensure that these facilities are continuously available and that they operate at peak efficiency.

c. Improve the capabilities and usefulness of these facilities and thereby mitigate the effects of obsolescence.

'd. Provide a better and safer environment for all personnel.

e. Provide for significant reductions in energy consumption through the initiation of energy conservation projects including improved utility control systems.

This program includes only facility rehabilitation and modification work having an estimated cost not in excess of $500,000. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance or by related routine facility work efforts that are provided for in other than CoF estimates. Rehabilitation and modification work estimated to cost more than $500,000 is reflected as a separate major CoF line item project.

PROJECT DESCRIPTION:

Proposed rehabilitation and modification projects for FY 1982 totaling $20,000,000 are described under "PROJECT COST ESTIMATE". Only those projects estimated to cost less than $150,000 have not been individually described or identified by center. The total cost for these miscellaneous projects is $1,095,000. This program has been distilled from requests of about $38 million and thus represents a modest request in relation to the backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are considered to be of the highest priority. Deferral of this mission essential work would adversely impact the availability of critical facilities, program schedules, and energy conservation goals.

During the course of the year, some rearrangement of priorities may be necessary. This may force a change in some of the items to be accomplished. Any such change will be accomplished within available resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE".

a.	Utility Systems	5,220,000
b.	Fire Detection/Protection Systems..	1,645,000
c.	General Purpose Buildings	1,245,000
d.	Technical Buildings/Structures	11,330,000
e.	Pavements and Drainage	230,000
f.	Building Exteriors and Roofs.	330,000

PROJECT COST ESTIMATE:

A.	Ames Research Center (ARC)...	1,775,000
1.	Modification of the 7x10-Foot Subsonic Wind Tunnel.....	480,000

This project modifies the scale balance system that is used to measure forces and moments on test models in the 7x10-Foot Subsonic Wind Tunnel. The existing 40-year old system is obsolete and unreliable. Repair parts are no longer available and downtime due to malfunction has become costly. This project includes the removal of the existing scale equipment and the installation of a modern scale balance system that is similar to the one used in the 40x80-Foot Wind Tunnel. This project includes the expansion of the existing control room to house and protect new instrumentation and equipment. This work includes associated heating, ventilating, air-conditioning, and electrical work.

2.	Modification to Various Buildings for Fire Protection.....	210,000

These resources provide fire protection and safety modifications in Buildings N-221, N-236, N-239, N-244, and N-245. The modifications in this project provide for safe egress from these buildings in the event of fire. This work includes providing an interior stairway from the second floor of Building N-221, the installation of emergency exits from the second floor in Building N-236, enclosing stairways in Buildings N-239 and N-244, and providing proper egress with fire resistant walkways on the roof in Building N-245. All

exits and enclosures will meet the requirements of the Uniform Building Code and the National Fire Protection Association (NFPA) Codes.

3. Modification of the High Reynolds Number Channel Muffler..... 150,000

This project provides for modifications to the two High Reynolds Number channels in Building N-231, Fluid Dynamics Laboratory. These two blowdown facilities originally used helium as the test medium. The high cost of helium necessitated recovery by vacuum sphere. The requirement to use helium no longer exists and air is now the test medium. By exhausting air to the atmosphere, as opposed to the vacuum sphere, run times can be increased. This project provides for the necessary piping, a muffler, a concrete pad for the muffler and a 36-inch (91 centimeter) gate valve to exhaust the system to the atmosphere. This increase in run time is necessary to support basic research and development (R&D) work used to assist in the development of computer codes used to predict fluid flows characterized by viscous effects.

4. Rehabilitation of Hangars and Ramps..... 440,000

This project rehabilitates the Flight Support Facility, Building N-211, the Aircraft Servicing Facility, Building N-248, and the aircraft ramp which provides access to these facilities. Over the years, the floor surfaces of both hangar type Buildings, N-211 and N-248, have become worn, stained, and difficult to clean and maintain. This project will, by the application of an epoxy floor coating, enhance the work environment by allowing cleanup of spilled fluids and thereby improve the safety. In addition, a truck mounted crane is being used in Building N-211 to move heavy equipment. The crane moves along the floor lifting and lowering loads in the hangar. This poses a safety problem especially when the hangar is congested. A three-ton bridge crane will be installed to alleviate the problem. The aircraft ramp is sloped toward Building N-211 and causes flooding during heavy rains. A trench will be installed along the south side of the building to correct this problem.

5. Modification to 2x9-Inch Turbulent Flow Duct..... 310,000

These resources provide for modifications to the 2x9-Inch Turbulent Flow Duct in the Thermal Protection Laboratory, N-234. This facility is used for evaluating thermal protection systems. The test section as it is presently configured does not have any optical ports. Consequently test specimens can not be observed during test runs. Test specimens with protrusions or deflected surfaces cannot be tested because of the closed jet test section. This project provides for the installation of a surplus open jet test section with optical parts, a new two dimensional nozzle, model support system and associated piping necessary for cooling the nozzle. This work will allow for testing of deflected surfaces or protrusions greater than 1/2 inch (1.2 centimeter). This research is necessary to support entry technology development.

6. Modification of Chemical Research Projects Facility, Building N-223.. 185,000

This project modifies the Chemical Research Projects Facility, Building N-223. This facility, formerly a flight range for hypervelocity ballistic guns, is now used for testing fire retardant materials used in aircraft. This project will reconfigure the space to accommodate test equipment and bench fire tests. Included is the installation of fume hoods, a new heating, ventilating and air-conditioning system, new flooring and ceiling as well as associated electrical work. Approximately, 3,000 square feet (228 square meters) of space is involved.

B. Dryden Flight Research Center (DFRC)..... 1,125,000

1. Modification for a Simulation and RPRV Laboratory, Building 4801 450,000

This project modifies approximately 6,220 square' feet (578 square meters) of space on the first floor of the Aircraft Construction and Modification Hangar, Building 4801. This facility formerly a sheet metal shop will be modified for the installation of flight simulation computers to support aeronautical research programs. Work includes the installation of partitions, a raised floor system, lights, and heating, ventilating, and air-conditioning system. The work also includes the related modifications to the electrical and fire protection systems. The existing Remotely Piloted Research Vehicle (RPRV) laboratory is too small to accommodate the increase in activities currently being performed. This additional space will allow for an increase in computational capability, thus providing a 21 - 30% savings in software development manhours. This will be accomplished by the reduction from a 3-shift operation to a 2-shift operation.

2. Rehabilitation of Building 4800 335,000

These resources provide architectural, structural, mechanical and electrical rehabilitation of approximately 150,000 square feet (1,343 square meters) of space on the second floor of the Research and Development Test Facility, Building 4800. The interior work will consist of rehabilitation of floors, walls, ceilings, lighting fixtures and miscellaneous hardware. Building 4800, the main office building at DFRC, houses the administrative functions of the center. This building has been in constant use over the past 25 years and with the exception of air-conditioning modifications in 1972, has not been upgraded or rehabilitated. A survey of the attic spaces indicates a need to upgrade the electrical wiring, ductwork and piping.

3. Modification for Utility Control System 340,000

This project extends and enhances the monitoring and control capabilities of the Utility Control System. Additional control and increased capabilities will be installed so as to provide more sophisticated energy management i.e., optimization of energy controls and variable night set-back point. The utility systems that will be monitored and controlled include heating, ventilating, air-conditioning, lighting, electrical power, fire detection and security. The installation of sensing and control devices will conserve additional energy resources, and reduce maintenance and operating manpower.

C. Goddard Space Flight Center (GSFC) 1,505,000

1. Modification for Fire Protection and Safety 250,000

These resources provide for the modification of Buildings 1, 2, 8, 21, and 23 to achieve an improved level of fire protection and safety for personnel. This work includes the installation of automatic sprinkler systems in currently unprotected areas of these buildings and additional exits for emergency egress of personnel. It is part of a planned program to improve the level of fire protection of GSFC facilities. A high level of "built-in" fire protection is required because fire protection services are provided from an off-site department, the nearest component of which is about a mile and a half away.

2. Modification of Data Interpretation Facility, Building 23... 315,000

These resources provide for modification of 3,300 square feet (309 square meters) on the first floor in Building 23 to allow installation of electronic data processing equipment for the Data Switching Facility. The modifications include partitions, lighting, heating, ventilating, and air-conditioning, raised flooring and a 50 kva uninterruptible power supply system. These modifications are necessary at this time so that a new concept in information retrieval, packetized data handling, can be used to support the Earth Radiation Budget Experiment (ERBE), Cosmic Background Explorer (COBE) and other missions.

3. Modification of Electrical System, Building 21..... 200,000

These resources provide for modification of the electrical system in the Meteorological Systems Development Facility, Building 21. Work includes the installation of a 100 kva uninterruptible power supply (UPS) system and a computer power control center. Also included is the modification of 500 square feet (46 square meters) in the basement of the electrical room of the facility to accommodate installed equipment. The UPS is required for stable, reliable electrical power to support the Science Operations Centers (SOC) located in Building 21. The SOC's support the International Ultraviolet Explorer, Pioneer-Venus and Upper Atmospheric

Research Sounder spacecraft programs. The UPS system is necessary to prevent the loss of spacecraft data and ground control in the event of power outages and line transients in the commercial power system.

4. Modification of Utility Control System 490,000

These resources provide for modifications to the utility control system in 25 buildings. Work includes the replacement of 74 electro-mechanical type field panels with new, all solid state equipment. Work also includes checking 1,200 remote field function sensors and replacing defective equipment. The present field panels and equipment were installed in the 1960's, and have become a significant maintenance problem. Replacement of the old field panels has been' determined to be more cost effective than modifying and calibrating them to be compatible with new Central station equipment. This project completes the overall UCS modernization program at GSFC.

5. Modification of HVAC System in Environmeqtal Testing Laboratory, Building IO..... 250,000

These resources provide for the modification of the HVAC system on the first floor of Building 10. Work includes the installation of a 40-ton (140 Kilowatt) air handling unit. The air distribution system and controls will be modified to improve the temperature and humidity controls in the first floor test area. A heating coil will be installed in the air handling unit to control the relative humidity of the supply air, and to provide for a wider range of temperature control serving the Space Environment Simulator (SES). The present environmental control conditions in this facility are inadequate for spacecraft test operations. Six interruptions during testing of the Solar Maximum Mission in the SES resulted from loss of temperature and humidity control. These modifications to the HVAC system must be done at this time for Shuttle Component Testing and the SES Shuttle test which require enhanced environmental control.

D. Jet Propulsion Laboratory (JPL)..... 1,910,000

1. Modification of Vacuum Chambers, Environmental Laboratory, Building 144..... 480,000

These resources provide for modification of the 10-foot (3 meter) and 7x14-foot (2.1x4.2 meter) chambers in the Environmental Laboratory, Building 144. This modification work includes replacement of the oil diffusion pumps with cryogenic pumps; provision of gaseous helium target shrouds for both chambers; and related piping, electrical and mechanical work. These modifications, to the vacuum chambers are necessary for testing spacecraft sensors being developed for outer planet missions. Cryogenic pumps are necessary to eliminate oil contamination of the sensors due to backstreaming. Currently planned instrument projects that require chamber testing at a

very low temperature range are the Infrared Radiation Limb Sounder, Hot Electron Bolometer, and K-Band Maser. The gaseous helium capability is essential in these two chambers to provide the extreme low temperature required for the development testing of these projects.

2. Rehabilitation of HVAC Plant, Buildings 171, 202, and 241. 495,000

These resources provide for the rehabilitation by replacement of the heating, ventilation and air-conditioning (HVAC) plant serving the facility complex of Buildings 171, 202, and 241. Work includes the installation of two 175-ton (615 kilowatt) chilled water machines, two low pressure dual fuel boilers to be located in the basement of Building 171, and related mechanical and electrical work. Buildings 171, 202, and 241 were constructed in the 1960's. A two-story addition was constructed on the north side of Building 241 in 1970. The three buildings form one continuous structure. The mechanical systems are fragmented and are a conglomerate of several systems. This conglomeration of small, inefficient, obsolete and worn-out equipment resulted from sequential construction of the complex plus modifications due to functional changes in assigned activities. The complex houses the emergency Deep Space Network Control Station, quality assurance functions, and the computer controlled graphics equipment. These vital functions must continue to operate during the installation of the new mechanical plant. It is planned that the old, small air handling units and air distribution system will be replaced at some future time.

3. Rehabilitation of Various Buildings for Fire Protection..... 455,000

These resources provide for the rehabilitation of Buildings 168, 169, 281, and 292 to achieve an improved level of fire protection and safety. Fire protection services are provided from an off-site organization located two miles from JPL. Work includes the installation of fire alarms, automatic sprinklers and related equipment to protect approximately 90,000 square feet (8,360 square meters) in these four buildings. This level of building fire protection is required to protect the personnel, high value research equipment and spacecraft components. This project is a part of a planned program to improve the fire protection and safety of the JPL facilities.

4. Modification of HVAC Systems, Buildings 125, 161 and 238 480,000

These resources provide for modification of the HVAC systems in Buildings 125, 161 and 238 to conserve energy. Work includes the installation of a heat recovery type double bundle condenser chiller, hot and chilled water storage tanks, circulating pumps, and related equipment for optimizing energy usage in these three buildings. Control systems will be installed to permit the chillers to operate either in a heat recovery mode or as heat pumps, depending on the heating and air-conditioning demands. One chiller in each building will be replaced and the second chiller will be refurbished as a standby. Associated secondary mechanical and

electrical systems in Buildings 125, 161 and 238 are about 20 years old, in a poor state-of-repair, and will be replaced. The efficiency of the chillers and the cooling towers has lowered to a point where existing standby equipment must also be operated to meet demand loads. This has also contributed to an increase in energy consumption. The installation of the central cooling tower in a prior years project gives the capability to replace the old cooling towers at this time. This project will extend the useful life of the existing chiller plants by 12 years. Energy savings are estimated at 130,000 kwh of electrical power and 240,000,000 cubic feet (6,800,000 cubic meters) of natural gas per year with a simple payback of about 4.5 years.

E. Johnson Space Center (JSC)..... 1,795,000

1. Modifications for Replacement of Computer, Building 12..... 175,000

This project is the first phase of a 2-year program to replace UNIVAC 1108 computer systems in the Central Data Office, Building 12. This phase includes disconnecting and removing computer equipment from the building, modifying areas on the second floor, and installing a new computer system. Second floor modifications include: redistributing electrical power; installing additional air-conditioning equipment and providing a closed-loop cooling system; providing changes to the signal grounding system; relocating walls and adding some computer flooring to accommodate the new equipment.

The new computer will take advantage of more economical and newer data communication systems, while replacing one existing UNIVAC 1108 computer. The new system will increase computing capabilities required by various programs of the shuttle era, including the payload and orbiter operations. The new computer system cannot be installed or used without completion of this project.

2. Rehabilitation of Air Compressors, Building 24..... 445,000

These resources provide for the final phase of a 2-year program to rehabilitate the air compressors in Building 24 (Central Heating and Cooling Plant). During this phase, the utility air supply system will be rehabilitated by replacing two reciprocating compressors with one centrifugal compressor. The project includes removal of the two 1,024 cubic feet per minute (483 liters per second) reciprocating compressors and installing one new 2,600 cubic feet per minute (1,226 liters per second) centrifugal compressor. The associated piping, air intake filters, electrical modifications, and controls are included.

The existing compressors are the reciprocating type with Teflon piston rings which require extensive maintenance and have high replacement parts costs. The proposed centrifugal air compressors require little maintenance by comparison. The centrifugal compressors will produce a lower noise level, partially alleviating

the noise problem in the plant. It is essential that this compressor system operate without unplanned downtime, since it provides air to meet institutional and programmatic requirements throughout the mall area of JSC.

3. Modifications for Fire Protection, Utility Tunnel System.. 345,000

These resources provide for the installation of a manual fire alarm pull box system, an automatic fire detection system, and a manual fire suppression system in the JSC utility tunnels. The detection system will consist of line-type heat detectors installed in cable trays together with new photoelectric, spot-type smoke detectors mounted on the tunnel ceiling in areas of wiring congestion. Seven new fire alarm panels, together with other components required for a complete and operable tunnel fire alarm system, will be connected to a readout panel located in the Fire Station. Manually controlled fixed-pipe water deluge systems will be installed at congested locations throughout the tunnel. A new hatch opening will be installed, which together with some existing openings, can be used for introducing foam into the tunnel from mobile equipment. Fire and smoke barriers will be installed across the tunnel at various locations to direct this foam into particular tunnel sections and to contain tunnel fires. One new ventilation shaft will be added and the existing tunnel ventilating system altered to permit foam flooding of the tunnel.

The automatic fire detection/suppression system in the utility tunnels is needed because: the area is virtually inaccessible for firefighting purposes, and a fire in cable insulation produces large quantities of spreading toxic fumes and dense smoke, making it difficult to pinpoint the fire origin. Early detection and suppression are essential. Fires in cables can cause extensive physical damage and lengthy power interruptions to critical flight control facilities at JSC.

4. Modifications to Chambers A and B, Building 32 355,000

These resources provide for safety modifications to the oxygen gas supply/distribution systems, and side sun service facilities in Chambers A and B of Building 32, Space Environmental Simulation Laboratory. These large, man-rated thermal-vacuum test chambers provide for development and qualification testing of space hardware. They are considered to be a national resource inasmuch as they provide man-rated thermal vacuum test capability for other agencies as well as other countries.

The modifications to the oxygen gas supply and distribution systems include such work as constructing an 8-foot by 2-foot (2.4 meter by .6 meter) shed with three sides enclosed, and installing remote facility panel controls for heaters, pumps, and selected valves therein; removing and replacing deteriorated piping, valves, fittings, and controls as required; replacing the main shutoff valve with a new leak-tight valve; and reworking the GN_2 system serving the solar simulators in the thermal vacuum test chambers. Modifications to the oxygen system are needed because the remote facility panel controls are required for the environmental control system

operator to constantly monitor the pressures of the O_2 gas supply trailer. Critical O_2 system piping valves and regulators have been exposed to contamination and exterior weather conditions for approximately 13 years and require replacement. A new valve in the emergency repressurization system is required to stop the present unacceptable leakage. The existing low-pressure dry GN_2 purge system has deteriorated and must be replaced or modified to protect the existing 26 solar simulators from corrosion.

Modifications to the side sun service facilities in Chamber A will include revisions to the side sun elevator platform and the solar carbon arc burner support frames to provide a straight line access instead of the existing curved access. Modifications will also be made to the service cage of the side sun portable elevator used to service the solar simulator optics in Chamber A. The side sun is the portion of the solar simulation system which is on the side of the chamber. Modifications to the side sun service facilities are required to correct saftey hazards. Changes to the elevator platform and side sun steel frame are necessary to provide additiqnal working space in the center of the elevator for personnel to install the solar carbon arc burners. Modifications to the portable side sun elevator are necessary to comply with OSHA standards and to provide for emergency egress.

5. Modification of Air-conditioning and Heating Systems NASA Industrial Plant, Downey, California..... 475,000

This project is the final phase of a two-phase energy conservation program for the modification of air-conditioning and heating systems at the NASA Industrial Plant, Downey, California. The work includes modifications and repair of 12 existing air handlers in Building 006, additions to the control systems, ductwork, dampers, and insulation of ancillary equipment to provide "economy cycle" operation capability to these systems. In addition, new hot water supply and return lines will be extended from Building 119 to existing hot water loops serving air handlers in Building 009. This will eliminate the need to use the boiler in Building 009. The Building 006 modifications will allow an "economy cycle" operation which will afford the optimum utilization of outside ambient atmospheric conditions. When cooling is required and outside conditions are favorable, cooler outside air is drawn into the building to provide all or part of the required cooling. The same principle is followed to satisfy requirements for heating. This work is required to decrease natural gas and electricity consumption for air-conditioning. This project has a simple payback period of 3.6 years. The repair work is necessary because the system components have deteriorated and have become severely worn. Because of the condition of the existing equipment, system efficiency is greatly reduced and maintenance costs are excessive.

F. Kennedy Space Center (KSC)... 1,205,000

1. Modifications to Fire Protection Systems, Building M-7505..... 265,000

These resources provide for modifications to the fire protection system in Building M7-505 at KSC. Presently this building is equipped with only fire alarms, fire hoses and extinguishers. As the Space Shuttle program advances, an increasing amount of Shuttle ground support equipment (GSE) and flight hardware will be stored in this facility. This project will provide an automatic wet pipe sprinkler system to cover those areas in which the Space Shuttle related hardware will be stored. The work includes the installation of 400 sprinkler heads and 7,576 feet (2,273 meters) of piping to cover 41,000 square feet (3,690 square meters) of storage space and the installation of 240 feet (72 meters) of fire curtains,

2. Modifications to KSC Cable Plant..... 465,000

This project modifies the following KSC data communications cable runs: between Building K6-900 and K6-1193, M6-138 and M5-1494, M7-355 and M7-1061, and between M7-1061 and M7-1469. Cable requirements between these facilities will exceed the presently available wideband capability within the next two years. The work includes the purchase and installation of approximately 6.14 miles (9.84 kilometers) of fiber optics cable between the above sets of facilities. Cost studies have shown that the installation of conventional cable having the same capability as the fiber optics cable would cost in excess of $1,000,000.

3. Modifications to the Utility Control System (UCS)..... 475,000

This project provides for modifications to the KSC Utility Control System by adding sensors and controls to five (5) additional buildings in the Industrial Area. The buildings are the Central Cafeteria (M6-493), the Vertical Processing Facility (M7-1469), the Parachute Refurbishment Facility (M7-657), the Central Telemetry Building (N6-2296) and the Spacecraft Assembly and Encapsulation Facility No. 2 (M6-1210). These sensors will allow duty cycling of the utility systems and load shedding in the listed facilities to conserve energy. Work includes the purchase and installation of the sensors, as well as any necessary facility modifications. When this project is complete., energy savings of $214,000 per year are anticipated, resulting in a payback period of 2.2 years.

G. Langley Research Center (LaRC)..... 1,795,000

1. Modifications for Fire Protection, Buildings 1293A and 1293B..... 300,000

These resources provide increased fire safety for the 60 occupants in Buildings 1293A and 1293B by upgrading fire detection systems and fire egress systems in accordance with the latest fire safety and life safety codes. Built in 1963, these buildings are not in accordance with current safety requirements. The arrangement of offices and laboratories in these buildings, which are used for materials and structures research, is complex. Architectural inadequacies as well as fire detection system inadequacies were identified by a recent fire safety study at LaRC. The work for correcting this condition includes enclosure of stairwells, installation of fire rated doors, sealing of wall openings, and an exterior stair tower to protect personnel from fire and smoke. The fire detection system will be upgraded, designated fire egress routes will be clearly identified with lighted signs, and battery powered emergency lighting will be installed.

2. Modifications to Aircraft Noise Reduction Laboratory, Buildilng 1208..... 37s,000

This project modifies the anechoic room in the Aircraft Noise Reduction Laboratory, Building 1208, to improve subsonic and supersonic jet engines acoustics research. The present noise monitoring system consists of microphones at fixed positions throughout the room. Data from this system is useful, but limited. This project provides a motorized mapping boom system for moving a research microphone over an essentially infinite number of positions throughout a 7-foot (2 meter) radius hemisphere. The flow capability of the present system for supplying air to model jet engine nacelles and supersonic nozzles is inadequate for today's research needs, and the system is unreliable. A new system for supplying 6 pounds (2.7 kilograms) per second at 150 pounds per square inch (100 Newtons per square centimeter) will be provided by a connection to the 5,000 pounds per square inch (3,500 Newtons per square centimeter) supply system in the building. The new piping system includes pressure reducing and heating stations, valves and associated controls.

3. Modifications to V/STOL Tunnel, Building 1212C..... 450,000

This project modifies the model air supply'system in the V/STOL Tunnel, Building 1212C, for higher flow rates. Research in this tunnel has shifted from V/STOL aircraft to the low speed aerodynamic characterists of long haul and military aircraft. These include transports, helicopters and fighters. The model flow requirements for powered models of these aircraft are approximately double the flow capability of the present model air supply system. Using the 5,000 pounds per square inch (3,450 Newtons per square centimeter) air supply available at this facility, this project will provide for model flow rates up to 30 pounds (14 kilograms) per second at 212°F (100°C). Included are the necessary valves, steam heaters, temperature and pressure controls, and piping.

4. Modifications to Low Turbulence Pressure Tunnel, Building 582A..... 445,000

These resources provide the Low Turbulence Pressure Tunnel, Building 582A, with a suction-type active boundary layer control (BLC) system. This system will be used primarily for laminar flow and low Reynolds number airfoil research. It will also augment the tunnel's blowing-type active BLC system which is used for high lift airfoil testing. Boundary layers of air develop not only on the airfoils being tested, but also on the tunnel test section sidewalls. Without BLC to prevent such development, sidewall boundary layers can grow until they interact with and interfere with the airfoil's boundary layer. This can cause premature flow separation from the airfoil being tested. The active BLC provided by this project includes: the rehabilitation of two existing compressors; new compressor motors and electrical power supplies; installation of pourous sections and suction chambers in the test section sidewall:; and related piping and control systems. This system will remove boundary layer air from the test section sidewalls ahead of the airfoil being tested and reinject it back into the tunnel flowstream beyond the test section.

5. Modifications to 16-Foot Transonic Tunnel, Building 1146..... 225,000

This project modifies the high pressure air model propulsion system in the 16-Foot Transonic Tunnel, Building 1146. The current air system provides only one flow line, and the system's pneumatic controls are slow. As a consequence, models requiring only one flow system can be tested, and approximately one-half of the tunnel's operating time is spent stabilizing this system's controls and flow conditions. Plans for future work in this tunnel include support of the Transport Propulsion, Supersonic Cruise Transport and Highly Maneuverable Aircraft Technology programs. The research includes development of aerodynamic nozzle concepts and aerodynamic airframe-to-propulsion systems integration. Models of aircraft with variable cycle engine propulsion systems to be tested in support of this research require two separately controllable air flow lines for simulating such engines. This project reconfigures the present high pressure air model propulsion system to provide dual air flow lines with fast acting hydraulic flow and temperature control valves. Control of the modified system will be provided by a microprocessor controller. In addition to providing for research requirements, this project has a payback period of 3.5 years based on energy savings resulting from the improved, fast acting hydraulic controls.

H. Lewis Research Center (LeRC)..... 1,910,000

1. Rehabilitation of Lightning Protection System, Various Substations..... 290,000

This project will rehabilitate the lightning and switching surge protection at four major electric power substations at LeRC. At Substation A, both the 138 kv and 34.5 kv bus protection will be improved with the installation of six 3-phase sets of 121 kv arresters and two 3-phase sets of 36 kv arresters. At Substation

B, the improvement will include the installation of two 3-phase sets of 36 kv arresters. At Substation G, three 3-phase sets of 36 kv arresters will be installed. At substation K four, 3-phase sets of 121 kv arresters will be installed. Existing lightning protection at Substation A, B, G and K is provided by lightning arresters which are over 27 years old. Since these arresters were installed, the state-of-the-artin lightning protection has significantly improved. The rehabilitation being accomplished by this project will significantly improve the lightning protection at these substations. Many parts of the LeRC power distribution system (cables, insulators, transformers, switches, etc.) are as old as the arresters and represent many millions of dollars of capital investment. Installation of modern lightning and surge protection equipment is a cost effective method of extending the life of these aging components.

2. Modification to 6000 PSI Gas Storage and Transfer System, Rocket, Engine Test Facility... 470,000

This project will modify the existing gaseous hydrogen and gaseous helium storage and transfer system by the addition of three (3) 6000 psi (421 kilonewtons per square meter) pressure vessels, each approximately 4 feet (1.2 meters) in diameter and 38 feet (11.6 meters) long, and increase the capability of the transfer system. Included in the project are the repair, installation, and testing of three (3) available pressure vessels and pipe, valves and safety devices necessary to charge the vessels and to convey the gases to the test area. Lewis Research Center's planned chemical rocket technology program includes testing of high pressure thrust chambers to obtain fatigue and heat transfer data. Testing will be done using thrust chambers in the 20,000 pound (89 x 103 Newton) thrust range operating with hydrogen/oxygen and hydrocarbon/oxygen propellants at chamber pressures up to 2,000 psi (141 kilonewtons per square meter). Data gathered from these tests will be used in the development of techniques for high pressure hydrocarbon fueled engines. For the hydrogen/oxygen propellants, extensive testing is needed at high chamber pressure. Installation of the large volume, high pressure gas vessels will provide sufficient gas supply to allow such testing to be completed in about one-fourth the number of days as with the present gas system. Installation of these bottles and piping is a cost efficient means of performing the current and planned research testing in this facility.

3. Rehabilitation of Electric Power System at Substation G, Building 43..... 450,000

These resources will provide for the rehabilitation of Substation G, Building 43, by installing a new 3,750/4,687 capacity, 34.5 kv - 2.4 kv power transformer and new 5 kv secondary switchgear with associated foundations, high voltage disconnect switches, cables, grounding, protective relaying, and controls. Three existing load transformers presently fed from the G4 transformer 6.9 kv tertiary winding will be replaced with new 2.4 kv primary voltage transformers and will be powered from the new Sub G transformer. Over the years various research and institutional loads have been connected to the 6.9 kv tertiary winding of transformer G4. An alternate 6.9 kv power source is not available for these loads, and maintenance or repair in this area of the power system leaves these loads without service. The existing 10,000/13,333 kva G4 transformer is oversized

for present and anticipated loads. This project will allow this large transformer to be de-energized at all times except when needed to supply one unique 6.9 kv load deemed impractical to reconnect at 2.4 kv. This project will also provide an annual savings of approximately 130,000 kwh ($4,000) of electric energy by avoiding no load transformer losses.

4. Rehabilitation of the Heating, Ventilating, and Air-conditioning Systems in the Engine Research Building (5)..... 450,000

These resources provide for the rehabilitation of the mechanical system in the Engine Research Building Office, Section No. 5. The work includes removal of the deteriorated heating, ventilating, and air-conditioning (HVAC) system and the installation of a new variable volume cooling system with perimeter heating fin-tube system, individual room temperature control, and electric work as required to operate the mechanical equipment. The HVAC system will also incorporate an economizer cycle using outside air for cooling when possible. The building is 37 years old and has received only that maintenance required to correct emergency conditions. This rehabilitation is needed now to provide this test facility with an energy-efficient mechanical system.

5. Modification of Electrical Power System at Research Analysis Center 250,000

These resources provide for the modification of the electric power system at the Research Analysis Center, Building 142, by installing an additional source of 480 volt power to serve special computer power supply equipment. The 480 volt power system will consist of two outdoor 5 kv fused interrupter switches, two 500 kva outdoor 480 volt transformers, and two indoor 480 volt distribution switchboards. The current carrying capacity of the feeder between substation K and Building 142 will be increased to accommodate increased loads. Outdoor components will be installed on existing pads in the building transformer yard. Indoor components will be installed in an existing electrical distribution room. No building modifications are required for this project. The planned purchase of a Class VI supercomputer requires the proposed power system modification. This new class of machine requires 400 Hertz power for all central processing units. This need can be met most efficiently and at least cost by utilizing a 480 volt power source.

I. Marshall Space Flight Center (MSFC) 2,585,000

1. Modification for Central Chiller System, Phase II, 4600 Area..... 400,000

This second phase of a two-phase project provides for replacing the old and deteriorated chilled water air-conditioning systems serving Buildings 4610, 4618 and 4621 with a central chilled water system. The project consists of the procurement and installation of one electrically driven centrifugal 700-ton (21,700 kilogram) pneumatic controlled chiller, one 500-ton cooling tower adjacent to Building 4613, new piping, valves, strainers

and meters, and all electrical switchgear, conduit and wire to provide 4,160 volt electric service to the new chiller. Underground piping to connect Buildings 4610, 4618, and 4621 to the central chiller system is included within the project scope. The present chilled water systems include multiple air-conditioning makes, models, and sizes. The large number of chillers, pumps, cooling towers, and related equipment, coupled with the age (13-22 years) and the condition of the equipment, has placed an unmanageable maintenance burden upon the center.

2. Modification for Teleoperator/Robotics System Laboratory, Building 4619..... 420,000

These resources provide for the consolidation of two existing, limited area, simulation sites and for the establishment of the multipurpose, appropriately sized laboratory-type area needed to house the expanded simulation activities of remote manipulator systems. The work consists of construction of a 6-inch (15.24 centimeter) thick, 4,042 square-foot (375 square meter), reinforced concrete pad with 0.5-0.8-inch (1.31-2.01 centimeter) black epoxy leveling air-bearing surface to accommodate air-floated Mobility and Target Units in Building 4619. An area of 1,700 square feet (158 square meters) with a computer type floor will be provided for the Oribital Service System and the Protoflight Manipulator Arm. This area will be enclosed with a black fabric material 30 feet (9.12 meters) high, suspended from cables attached to the building frame. The fabric enclosure allows easy acess to the work area, simulates light conditions in space, and is more economical than a solid partition. Heating, ventilation, and air-conditioning will be provided to serve the test area, as well as 3,500-psi air, electrical power, and lighting systems. The completed project will support advanced robotics system evaluation, development and demonstration; and operating personnel training in the use of the systems. Such systems will be incorporated in future NASA programs for purposes of satellite rendevous, retrieval, repair, and servicing; and the handling, placing, and assembling of large structural elements in space.

3. Modifications to Provide Automation of Building Systems Management.. 460,000

This project will increase the use and efficiency of the existing computer-based utility control system (UCS) by the addition of energy conservation options including outside air temperature cutout and reset, economizer cycle, supply air reset, high temperature hot water reset, optimized chiller control, and damper closure. Modification of existing software, and procurement and installation of new hardware, will allow for implementation of these options within the existing UCS/Energy Management Systems for seven buildings (4207, 4487, 4570, 4619, 4705, 4708, and 4712). This computer-based UCS was designed to accept expanded energy-saving options and additional buildings. This project will result in more efficient utilization of the UCS, with a payback of 3.7 years.

4. Modifications to HVAC Systems, Various Buildings 460,000

These resources provide for energy conservation modifications to 21 buildings currently in operation and providing direct support to NASA programs at MSFC. The work includes modifications to fan drives, air distribution systems, and controls. The work will result in air supply flow reduction, minimum outside air requirement reduction, conversion of air distribution systems to variable air volume types, installation of economizer cycles, and application of heat recovery systems to reduce fuel consumption. These modifications, while maintaining the necessary working environment, will reduce energy consumption by 28 billion Btu's of fossil fuel per year, resulting in a simple payback period of 3.4 years.

5. Installation of Uninterruptible Power Systems, Building 4207..... 385,000

These resources will provide a static, uninterruptible power system in Building 4207 (Communications Facility) to replace the present no-break emergency motor generator set and 12-ton flywheel. The conversion will be to a solid state system consisting of a rectifier on the incoming power supply, a bank of direct current (D.C.) batteries charged through the rectifier system, an inverter to change the D.C. to 3-phase alternating current (A.C.), and associated switchgear and other hardware. The power system will be sized to handle the 250 kva load essential to sustaining the vital communication systems during commercial power outages. An uninterruptible power system is necessary at this facility to assure that communication systems linking MSFC with other NASA centers and with spacecraft are kept in operation at all times. The existing continously operating rotary equipment will have completed 125,000 hours by 1982, at which point the drive train will approach its critical maintenance stage, and reduction in reliability is anticipated.

6. Rehabilitation of Communications Shop, Building 4728..... 210,000

This project rehabilitates Building 4728. The work consists of major rehabilitation of floors, ceilings, walls, roof, plumbing, relocation of partitions, and modifications to the building entrance. Insulation will be added and building systems modified to satisfy energy conservation criteria. The removal of loading ramps on the east .side of the building and high voltage transformers (not in use) in the high bay area will also be accomplished. This 25-year old structure is to be retained as a communications equipment shop and warehouse. Therefore, this project is intended to extend the useful building life, improve functional operations, reduce maintenance efforts, and conserve energy.

7. Rehabilitation and Modification to Air Supply Systems, 4600 and 4700 Areas 250,000

These resources provide for the rehabilitation and modification of 3,500 psi high purity missile grade air system and the 500 psi industrial grade air system to permit maximum possible use of the lower cost industrial

grade air. The work will include installation of a new 500-foot (183 meter) long industrial grade air line between Building 4775 and Building 4744, a 500/100 psi pressure reducing station and interconnection to six existing air storage tanks and industrial air piping at the south side of Building 4707. Included is the modification of piping in each of the buildings of the 4700 area to transfer from missile grade to industrial grade air. The rehabilitation of compressors in Building 4705, 4613, 4612 and 4620 is included. Separators, dryers and filters will be provided at each of the compressors being rehabilitated. The costly missile grade air system has by necessity been used in locations where cheaper industrial grade air is not available. These modifications will replace the costly systems with adequate industrial grade air and will result in both manpower savings and an estimated 11 x 109 Btu annual fuel savings, and will result in a payback of approximately 4.1 years.

J. Michoud Assembly Facility (MAF)..... 980,000

1. Rehabilitation to Electrical Feeders #12, #13, #17, & 1/31..... 235,000

These resources provide for the replacement of underground feeders 1/12 and #13, the removal of single overhead feeders 1/17/31, and the installation of two new underground feeders 1/17 and #31. The deteriorated 37-year old feeders, 1/12 and 1/13, are composed of three paper insulated, lead-covered (PILC) cables extending 1,650 feet (503 meters) from the East Master Substation to Substation 1/14. These feeders serve the new 1,600 and 2,500-ton electric chillers which are located in the Central Heating and Cooling Plant, Building 207 and maintain environmental conditions in the Manufacturing Plant, Building 103. The existing 750-foot (229 meters) single aerial feeder 1/17/31 is a potential "single point failure" connecting underground feeders from the Master. Substation, through a selector switch to underground feeders from Building 350. Underground installation of feeders 1/17 and 1/31 will replace feeder 1/17/31 and will provide redundant service to the Contractor's Support Building 320, and to the Main Engineering Building 350/351. The new feeders shall be rubber insulated and copper shielded with a polyvinyl chloride jacket. In addition to the feeders, this work includes installation of manholes, ducting and all necessary switchgear. Delay or failure to implement this project increases the risk of power interruption to Buildings 207, 320, and 351, all of which are critical to the External Tank Program.

2. Rehabilitate Storm Drainage Pumps and Controls..... 230,000

This project rehabilitates pumps, motors, and controls associated with the storm drainage system at MAF. The existing system consists of two secondary pumping stations located in Buildings 304 and 143, each containing two electrically-driven pumps and one diesel pump, and the main pumping station located in Building 450 consisting of four diesel-driven pumps. This project includes repairing or replacing all gear drives, replacing the water level controls in the secondary pumping station, and replacing the outdated pneumatic

control system in the main pumping station with a modern solid-state control system. The storm drainage system prevents flooding of the Main Manufacturing Building when adverse weather causes the hydraulic gradient to rise above the floor slab. Due to the topography at MAF, all of the rainwater and any water that is pushed over the levee by a hurricane, induced tidal surge must be collected in drainage basins and pumped over the levee into the Michoud Canal. The existing storm drainage pump system has been in service since 1963 and examination of the equipment has uncovered evidence of advanced corrosion indicating a need for rehabilitation at this time. Delay of this project increases the risk of storm drainage system failure with possible extensive property damage and impact on External Tank production.

3. Modifications to Condensate Recovery, Buildings 110 and 103.. 150,000

This project provides for the installation of two condensate recovery units in Buildings 110 and 103. Each unit will consist of a condensate receiver, piping, valves, contaminant sensing controls, and a pump to recover condensate which is now being wasted. Recovered condensate will be returned to the boiler house for reuse. The areas of utilization are the process fluid area of VAB Cell "E", Building 110, and the major component cleaning facility, Building 103. Modifications to this system are necessary to recoup approximately 53,000 pounds per hour of condensate presently being wasted. Anticipated energy savings indicate a project cost payback period of 1.5 years.

4. Install Air Distribution System, Building 110..... 365,000

This project provides for the installation of four in-line fans, associated ductwork, and thermostatic controls to circulate hot air from the top of the Vertical Assembly Building (110) to the work areas at ground level. Recirculation of this hot air will reduce the energy required to heat lower levels of the building. The height of the Building permits heated air to rise above the area of utilization. Anticipated net energy savings indicate a project cost payback period of 1.4 years.

K. National Space Technology Laboratories (NSTL)..... 395,000

I. Modification of NSTL Computer Centers to Add Fire Protection Sprinkler Systems.. 190,000

These resources provide for the installation of automatic sprinkler systems and smoke detectors for fire protection in the 14 computer areas located in Buildings 1100, 1105, 1110, 1201, 1210, 3203, 3204, 4110, 4995, and 8201. Each automatic sprinkler system will have dedicated distribution piping, water supply line connection, special riser assembly, test valves, sprinkler heads and a water flow alarm switch. The smoke detectors and water flow alarm switches will be connected into the building fire alarm systems which will transmit alarm signals to the NSTL Fire Department via the Utility Control System. This work is required to

provide effective fire protection of essential electronic equipment installed at NSTL. This project will lower the potential for loss or damage to the fourteen (14) computers and will bring essential electronic equipment operations at NSTL into compliance with NASA Safety Standards.

2. Rehabilitation of Cooling Towers, Various Buildings 205,000

These resources provide for the replacement of air-conditioning system cooling towers at six buildings with packaged cooling towers constructed of noncombustible material. The cooling towers located at Buildings 2201, 2204, and 4110 were all installed during construction of the buildings in the 1963 to 1965 time period. These units are approaching the end of their economic life, are in a deteriorated condition; and require extensive repairs. The new cooling towers will have a capacity total of 640 tons, with the largest being a 450-ton tower. A life cycle cost analysis indicates that replacement would be more cost effective than repair/rehabilitation of the existing units.

L. Wallops Flight Center (WFC) **830,000**

1. Modification of Main Base Water Distribution System 430,000

This project provides for modification of the WFC Main Base water distribution system to meet the flow requirements of the fire protection system in the aircraft hangar area of Building D-1. The work includes replacement of unserviceable fire pumps in Building D-4 with three 3,000-gallon per minute (11,000 liter per minute) fire pumps and related controls. The water main from Building D-4 to Building D-1 will be replaced with a 14-inch (36 centimeter) main to provide the required water flow. Studies of the main base water distribution system and the fire sprinkler system in Building D-1 have shown the flow capability to be inadequate due to undersized, corroded, partially plugged piping and inoperable fire pumps. This project will correct this deficiency and assure adequate fire protection to personnel, research aircraft and administrative aircraft located in Building D-1.

2. Modifications for Fire Protection, Various Buildings 400,000

This project provides improved fire protection to 11 buildings throughout WFC. Included is the installation of automatic sprinkler systems and fire detection systems in Buildings U-25 and U-30; installation of automatic sprinkler systems in Buildings E-2, F-10 (machine shop and north wing), F-160, and Y-55; and the modification of the existing automatic sprinkler systems in Buildings E-134, F-7, X-15, and Y-15 to provide complete sprinkler coverage throughout. The wet-pipe automatic sprinkler system in Building N-116 (unheated storage building) will be converted to a dry-pipe system to eliminate loss of protection in the winter months due to frozen water lines. These buildings include rocket launch support space, radar facilities, rocket

assembly shop space, laboratory space, as well as office and general support space. This work will correct pressing fire protection inadequacies identified during an overall fire risk analysis of the Center.

M. Various Locations..... 1,095,000

1. Rehabilitation and Modification of 26-Meter Antenna at DSS-13, Goldstone.. 485,000

This project rehabilitates the alidade-post attachment on the 26-meter antenna at DSS-13, Goldstone to eliminate relative movement between the alidade and the antenna reflector. The work includes rehabilitation of the antenna foundation and the existing servo hydraulics by replacing obsolete and worn-out components. Also included are modifications to the electronic and mechanical systems to provide for X-band pointing capability. The antenna at DSS-13 has deteriorated as a result of 20 years of continuous use and exposure to weather. A failure of any of the systems proposed for rehabilitation in this project would place the antenna out of service for up to 12 months and severely impact DSS-13 advanced space systems support operations.

2. Rehabilitation and Modification of Various Buildings at Goldstone Complex.. 240,000

This project rehabilitates and modifies various buildings at the Goldstone Deep Space Communications Complex. Included is the rehabilitation and modification of roofs, walls and ceilings, vestibules and weather stripping. The air-conditioning equipment will be rehabilitated by the incorporation of an economizer cycle using outside air for cooling when possible; ductwork will be modified to provide improved HVAC balancing, and obsolete control equipment will be replaced with more efficient control systems. The lighting system will be modified by adding timer controls and daylight turnoff sensors, reducing lighting levels and changing from incandescent to flourescent fixtures. The buildings being rehabilitated are over 15 years old and have received only that maintenance required to correct emergency problems. This work will insure that these buildings continue to support NASA missions in a reliable manner and at minimum operating costs.

3. Modifications for Utility Control Systems at DSS-12, Goldstone 370,000

These resources will provide a utility control system (UCS) for the DSS-12 site at the Goldstone Deep Space Communications complex. This system is composed of a real-time microprocessor subsystem which will provide local monitoring and control of the engine generator plants, HVAC and lighting, fire protection, security, and power/water distribution systems. The UCS control center will be located in the Operations Building. Its electronic components will become an integral part of the station's operational support system. Should there be a failure in the UCS, the utility equipment would return to manual mode or to its normal operating mode. This project is intended to reduce operating costs by reducing energy consumption through improved control of facilities and equipment and reducing manpower which is required to keep operational risks

at acceptable levels. Programmatic support of spacecraft missions will also be improved through increased reliability and monitoring.

MISCELLANEOUS PROJECTS LESS THAN $150,000 EACH.....	1,095,000
TOTAL.....	20,000,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated $19 million - $23 million per year will be required for the continuation of this rehabilitation and modification program.

MINOR
CONSTRUCTION
OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

MINOR CONSTRUCTION

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	485.000	CF 13-2
Goddard Space Flight Center	490.000	CF 13-3
Jet Propulsion Laboratoray	650.000	CF 13-4
Kennedy Space Center	235.000	CF 13-4
Langley Research Center	655.000	CF 13-5
National Space Technology Laboratories	925.000	CF 13-6
Wallops Flight Center	365.000	CF 13-8
Various Locations	195.000	CF 13-9
Total	4.000.000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE:	Minor Construction of New Facilities and Additions to Facilities, Not in excess of $250,000 Per Project
INSTALLATION:	Various Locations
	FY 1982 CoF ESTIMATE: $4,000,000

FY 1980:	$3,500,000	FY 1981:	$4,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

SUMMARY PURPOSE AND SCOPE:

These resources will provide for minor facility construction at NASA field installations and Government-owned industrial plants supporting NASA activities. Each project included in this program is estimated to cost less than $250,000 and involves either the construction of new facilities or additions to facilities. The FY 1982 request of $4,000,000 will improve the usefulness of NASA's physical plant by changing the utilization of or augmenting the capabilities of various facilities. Included in this request are those programmatic and institutional projects considered essential to the accomplishment of mission objectives.

PROJECT JUSTIFICATION:

The configuration of NASA's physical plant necessarily must respond to changes in utilization and adaptations required by changes in technology or in mission needs. Demands are generated by research, development, test, and similar activities. Specific justification for each minor construction project is provided by center under "PROJECT COST ESTIMATE."

PROJECT DESCRIPTION:

Included in the FY 1982 minor construction program are those facility projects supporting institutional or technical facility needs which could be adequately identified at the time of submission of this budget estimate. Items of work totalling $4,000,000 are included in this resource request and have been distilled from a list totaling about $5,900,000. The selection was based on the relative urgency of each item and the expected return on the investment. During the course of the year, rearrangement of priorities may require changes in some of the items to be accomplished. Such changes will be accommodated within the resources allocated.

These projects represent requirements that must be met in this time frame to support institutional goals and programmatic objectives. The following listing summarizes the cost distribution by category of work.

a. Technical Buildings/Structures	2,615,000
b. General Purpose Buildings	1,205,000
c. Pavements and Drainage	180,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC)...	485,000
1. Construction of a Compressed Gas Cylinder Facility	240,000

These resources provide for construction of a covered storage building for segregated storage of cylinders containing flammable and inert gases and oxidizers. The existing compressed gas cylinder storage facility is inadequate because it does not have a loading dock. This situation has directly led to two accidents in which cylinders fell from truck beds. The cylinders are stored with the highly flammable substances in overcrowded conditions. This project provides for the construction of an 3,850-square foot (357 square meter) block building and a loading dock. The floor will be concrete slab over compacted fill. The roof will be plywood over wood joists supported by wood beams. The building will be located on the North side of the Supply Support Facility, N-255.

2. Construction of a U-2 Ground Support Facility	245,000

These resources provide for construction of 3,500-square foot (325 square meter) metal pre-engineered structure for support of ER-2 aircraft. This building will be used to house ground support equipment and

deployment containers such as hatch containers and carts. Because the ER-2 requires different equipment from the existing U-2 supplies, parts must also be stored. The new building will provide secure long-term, efficient storage area. Two trailers now being used to partially meet this need will be removed.

B. Goddard Space Flight Center (GSFC)..... 490,000

1. Construction of a Hazardous Materials Storage Facility..... 245,000

These resources provide for the construction of two buildings on a site approximately 300 feet (90 meters) north of the Mobile Equipment Support Facility, Building 27, for the handling and storage of hazardous chemicals, gas cylinders, and class "C" explosives. The first building will be a 1,800-square foot (167 square meter) one-story concrete black structure. This building will have four separate cells for handling incoming chemical shipments and outgoing chemical waste as well as a three sided area for storing gas cylinders. The chemical handling and storage areas will have manual and automatic deluge systems drained to separate leaching pits. The second building will be a 334-square foot (31 square meter) one-story concrete block structure. A concrete wall will divide this building into separate areas for handling and storing explosive devices. Both buildings will be provided with lightning protection and the entire facility surrounded by a security fence. At the present time, the center has no facility for safe inspection, packing or uncrating of class "C" explosives, (i.e., squibs, boltcutters, cablecutters). The current practice of storing hazardous chemicals in laboratories or corridor storage cabinets is contrary to applicable safety standards. This project will eliminate the unsafe conditions and provide the GSFC with an adequate level of protection for personnel and property.

2. Construction of a Propulsion, Cryogenic and Fluid Flow Facility..... 245,000

These resources provide for construction of a 2,500-square foot (230 square meter) one-story brick and concrete mansonry building at the Propulsion Test Site in Area 400. Space will be provided for instrumentation control, equipment testing, two electronic laboratories, a data reduction and conference room, and office space for six people. Heating, ventilating, air-conditioning, lighting, electrical power, water and restroom facilities will be provided. This building is needed to replace instrumentation and office trailers which are over 15 years old, require frequent repairs, and have inadequate heating and air-conditioning systems. It is necessary at this time to provide adequate facilities for testing of high energy propellant systems proposed for Shuttle-deployed spacecraft.

C. Jet Propulsion Laboratory (JPL)..... 650,000

1. Construction of Antenna Test Range, Table Mountain..... 245,000

These resources provide for construction of an antenna test facility at Table Mountain, California. Work includes construction of an elevated 145-square foot (13.5 square meter) concrete pad about 200 feet (61 meters) east of Building TM 21. The antenna mounting, positioner control system and related equipment will be included. The antenna test range is required for testing advanced antenna concepts in support of Shuttle payloads. Table Mountain was selected as the site for this facility because the new generation of one milimeter (mm) wavelength range antenna requires fixed-base testing at a high altitude. Development of this high altitude antenna test range is deemed essential to the advanced spacecraft antenna development work at JPL.

2. Construction of Systems Assembly Building, Edwards Test Station..... 230,000

These resources provide for construction of a 950-square foot (88.3 square meter) concrete block assembly building to support Test Stands A and B at the Edwards Test Station, California. The building will be 22 feet (6.8 meters) wide and 44 feet (13.4 meters) long including a 30-foot (9.1 meter) high bay assembly and checkout area of approximately 250 square feet (23.2 square meters). This work also includes lighting, electrical power, fire protection, heating, ventilating, and air-conditioning systems. This facility is required to consolidate scattered test and systems preparation shop work which support propulsion research and development. This new building will replace several small, old, substandard shop buildings. Combining these shops into one central location will improve assembly and maintenance activities, and provide essential working conditions for effective utilization of personnel and equipment.

3. Construction of Addition to Propellant Mix Building E-34, Edwards Test Station..... 175,000

These resources provide for construction of a 265-square foot (24.6 square meter) concrete block addition to the Propellant Mix Building E-34 at the Edwards Test Station, California. The existing doors and pressure relief panels will be removed and reused to provide access to the new addition. The new area will accommodate safe mixing operations and provide space for related support equipment. The propellant operations are in support of the Advanced Propellant Mixing Concepts and Shuttle Nozzle Development programs.

D. Kennedy Space Center (KSC)..... 235,000

1. Construction of Hazardous Waste Storage Areas..... 235,000

These resources provide for the construction of two pre-engineered metal buildings for the storage of

hazardous waste materials. Each building will cover 4,800 square feet (432 square meters) and will hold approximately 200 drums of waste material. The work includes a concrete slab for each building, necessary sumps and dikes for spill containment, fire detection systems, and security fencing. One building will be used for the storage of polychlorinated biphenyl (PCB) waste. The other will be used for the staging of organic wastes (contaminated alcohol, unrecoverable hydrocarbons, and solvents) awaiting disposal vendor pick-up.

E. Langley Research Center (LaRC) 655,000

1. Construction of Addition to Building 1195A... 240,000

These resources provide for construction of a 3,800-square foot (350 square meter) one-story addition to Building 1195A. The exterior appearance and materials will match those of the existing Building 1195 complex. Included is all necessary heating, ventilating, air-conditioning, plumbing, and electrical work. This addition will provide space for the LaRC Acquisition Division's personnel. Using demountable partitions, offices for 23 people will be provided as well as space for files, data processing equipment, bid openings, proposal evaluations, and negotiations. The building currently occupied by these people is scheduled for demolition. By locating these 23 people adjacent to the division's main operations in Buildng 1195A, close coordination between all the various organizations and individuals in the division will be greatly simplified.

2. Construction of Addition to Building 1250..... 235,000

These resources provide for construction of a 2,560-square foot (240 square meter) single-story addition to the Environmental and Space Sciences Laboratory, Building 1250. The addition will be high bay space approximately 20 feet (6 meters) high and will match the existing building in appearance and materials. This space is required to house research equipment and associated controls used for vibration and pressure testing of developmental aerospace flight hardware. The addition will contain 1,990 square feet (185 square meters) of laboratory space for electro-mechanical vibration testing systems and for assembling and testing fluid and pressure systems. The remaining 570 square feet (55 square meters) of the additiqn will be a covered receiving and staging area for the aerospace hardware being tested in this building addition. The testing area and the covered receiving and staging area will have a monorail hoist system for handling the test articles. All mechanical and electrical building systems will be installed including heating, ventilating, air-conditioning, water, service air, and electrical power systems.

3. Construction of Paved Areas 180,000

These resources provide for the construction of sidewalks, off-street parking areas and vehicle turn-arounds to improve vehicular and pedestrian traffic flow in the administrative area of the Center. Moffett Road between Buildings 1152 and 1219 will be replaced with sidewalks and landscaping, and turn-arounds for Moffett Road traffic will be constructed at Buildings 1152 and 1219. Walcott Road between Moffett Road and Durand Road will be demolished and replaced with sidewalks and landscaping, and the parking lot between Buildings 1194, 1195A, 1195B, 1195C, and 1225 will be expanded by incorporating a portion of an adjacent floor slab from a demolished building. Associated storm drainage, manhole, water system, and electrical and telephone duct bank work required for this construction is included.

F. National Space Technology Laboratories (NSTL)..... 925,000

1. Construction of Addition to the Repair & Fabrication Shop, Building 2201..... 235,000

These resources provide for the construction of a 4,750-square foot (442 square meter) addition to the Repair and Fabrication Shop, Building 2201. This addition will be constructed of reinforced concrete masonry unit walls with a reinforced concrete slab and grade beam foundation. The roof system will be of insulated built-up roofing membrane supported by steel deck and bar joists. Heating, ventilating, air-conditioning, electrical, and plumbing systems will be included. The existing 5,520 square feet (513 square meters) will be modified by rearranging partitions and adjusting the lighting and other utility systems. The new addition will provide space for the central work control function and other support requirements for the shops and fire department. Modifications to the existing space will be modified to better accommodate the 24-hour a day operation of the fire and security departments.

These activities are assigned space in Building 2201 for their administrative and operational functions. The independent nature of the functions, and the fact that separate contractors provide these services, requires separate areas for proper contract performance. The increase in the overall site population has resulted in increased numbers of personnel for the security and work processing activities at the NSTL. This has resulted in overcrowding of available space. The fire and security services are staffed 24 hours per day, 7 days a week, and the fire department requires overnight accommodations for their personnel. This modification will provide for separation of functions and relieve the present overcrowded conditions.

2. Construction of Addition to and Rehabilitation of Environmental Research Laboratory, Building 2423 200,000

These resources provide for the addition of a 1,050-square foot wing, and reroofing and modernizing the exterior of the Environmental Research Laboratory building. Large wood framed windows and doors, and wooden porches will be replaced by smaller insulating glass metal windows/doors and concrete porches. The asbestos siding will be replaced by an insulating exterior facade extending to the ground to enclose the exposed underside. The enclosure of exposed rafter overhang with fascia/soffit and use of paneling/plaster at the window openings will modernize the appearance while reducing maintenance costs. Rearrangement of the internal laboratory and office space will be accomplished to provide more efficient space utilization.

The chemists, microbiologists and biologists of the Environmental System Laboratory (a part of the NASA Earth Resources Laboratory) who occupy this facility are responsible for a number of research programs and environmental monitoring actions which have increased greatly in scope. Areas occupied were originally constructed as office space and have been modified into laboratory space. Rearrangement of the existing space and the new addition will improve operations by consolidating the laboratories. It will allow the disposal of a 1,000-square foot (92.9 square meter) trailer, which is in poor condition, and a 120-square foot (11.1 square meter) adjacent portable building which presently supports laboratory activities.

3. Construction of Occupational Health Facility Addition to Building IIOO..... 245,000

These resources provide for the construction of a 3,000-square foot (279 square meter) addition to Building 1100. The structure will consist of a concrete slab on grade and precast concrete wall panels matching the motif of the existing building. The roof system will be insulated built-up roofing membrane supported on steel deck and bar joists. The interior partitions will be of vinyl covered gypsum board on metal studs. Necessary heating, ventilating, air-conditioning, electrical and plumbing systems will be included. Rearrangement of approximately 1,500 square feet (139 square meters) of the existing occupational health space adjacent to the addition will include partition changes as well as lighting and air-conditioning system changes.

The existing medical clinic serving 1,700 federal employees and 1,600 contractor personnel at NSTL is housed in a severely overcrowded area of 1,500 square feet (139 square meters). It was constructed in the early 1960's to provide emergency medical care for 150 federal employees and the large contractor work force then employed. The current health program, in accordance with federal regulations and industrial standards, emcompasses maintenance and improvement of employees health as well as provision of emergency treatment. These medical services are included in NASA's agreements with tenant agencies and in lab agreements with the various support contractors. The examination and treatment rooms are too few in number. The electrocardiogram,

hearing, and visual acuity test rooms are very crowded and separated from the clinic. To correct these deficiencies, a 4,500-square foot (418 square meter) facility is required and a 3,000-square foot (279 square meter) addition adjacent to the existing clinic will best satisfy this requirement.

4. Construction of Engineering Services Building 245,000

These resources will provide for steel framed structure of approximately 5,000 square feet (463 square meters) in the industrial area. The construction will include site development and erection of a pre-engineered structure on a reinforced concrete slab on grade. Electrical, heating, ventilation, air-conditioning and plumbing systems are included.

This building will house personnel of the engineering services activity at NSTL. The engineering personnel are presently housed in old wood frame houses, which were converted into office space in the early sixties, and four trailers. The trailers are over 18 years old which exceeds the life expectancy of 10 years. The houses, which are 30 to 40 years old, do not provide an environment conducive to engineering and administrative activities, and are difficult to maintain. The roofs, windows and other material elements of these structures have deteriorated to the extent that the environmental conditions within these structures are not satisfactory and are costly to improve. The consolidation of various engineering functions into this building will provide an improved arrangement and a professional atmosphere consistent with the quality of services required. The consolidated location of engineering personnel will afford significant savings in both energy and maintenance costs over the existing fragmented arrangement. This facility will house approximately 35 engineering personnel.

G. Wallops Flight Center (WFC) 365,000

1. Construction of Addition to Jet Fuel Storage Facility 150,000

These resources provide for the construction of an addition to the Jet Fuel Storage Facility to provide a 30-day storage capacity of JP-4 fuel. Work includes the installation of two 20,000-gallon (76 kiloliter) storage tanks and all related equipment. This work is required to provide a total capacity for JP-4 fuel of 100,000 gallons (379 kiloliters). The additional storage of JP-4 fuel is required to support the increased aeronautical research flight activities at WFC.

2. Construction of Addition to Launch Support Shop (X-15).. 215,000

This project provides a 6,000-square foot (557 square meter) mezzanine addition within the Launch Support Shop, Building X-15. Work includes the construction of partitions, flooring, ceilings, lighting, a heating, ventilating and air-conditioning system, and related electrical work. This project will provide for

more effective launch support operations by consolidating an operational and engineering launch support group of 50 people. Consolidation will permit the elimination of two old inadequate buildings and a steam plant which are in need of rehabilitation.

H. Various Locations.. 195,000

1. Construction of Support Facility for Mobile Lasers..... 195,000

These resources provide for the construction of support facilities for a Satellite Laser Ranging (SLR) station at Mazatlan, Mexico. This station is required to measure crustal movement along the San Andreas fault. These investigations of continental drift and interplate faulting contribute to the ultimate goal of earthquake prediction. SLR is a relatively new but proven technique for precise measuring of distant points on earth. It is 10 to 100 times more accurate and much more rapid than conventional surveying or even satellite doppler tracking.

Included is site clearing/grading, access road construction, concrete hardstand installation, connections to commercial power, grounding, security fencing, lighting, and sanitary facilities. Within the concrete hardstand is a survey marker support column constructed independently of the hardstand slab and extending to a firm underlying strata to provide a stable reference point. The column contains a brass survey tablet which is the geodetic control point.

TOTAL..... 4,000,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that between $3 million and $5 million per year will be required for the continuation of this essential minor construction work.

FACILITY PLANNING
AND DESIGN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

SUMMARY

FACILITY PLANNING AND DESIGN

	Amount	Page No.
Regular Requirements:	7,470,000	
Master Planning.....	200,000	CF 14-2
Sustaining Engineering Support.....	1,120,000	CF 14-2
Preliminary Engineering Reports and Related Special Engineering Support.....	2,300,000	CF 14-5
Final Design.....	3,850,000	CF 14-6
Other Requirements:	3,530,000	
Space Shuttle Facility Planning and Design.....	1,900,000	CF 14-6
Spacelab/Payloads Facility Planning and Design.....	580,000	CF 14-7
Energy Reduction Analysis and Support..	1,050,000	CF 14-7
Total.....	11,000,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1982 ESTIMATES

PROJECT TITLE:	Facility Planning and Design		
		FY 1982 CoF ESTIMATE:	$11,000,000
FY 1980:	$14,000,000	FY 1981:	$10,000,000

The funds requested in this estimate are required to provide for the following advance planning and design activities related to facilities activities and projects.

a. The accomplishment of necessary development and master planning for field installations and, where not otherwise provided for, the provision of continuing engineering support and special engineering management and other services.

b. The preparation of preliminary engineering reports, cost estimates, and design and construction schedules.

c. The preparation of final construction plans, specifications, and associated cost estimates and schedules required to implement construction projects.

d. The accomplishment of facilities siting and other investigations, studies and reports.

Regular requirements encompass the basic purposes outlined above. The "other requirements," while also in support of these purposes, cover those special needs related to large, complex projects or specific programs considered to represent high potential future construction requirements and for which early definition is essential. The large projects require more planning and longer lead time than is normally involved. Much of this planning must be completed prior to inclusion of the project in a budget request.

1. REGULAR REQUIREMENTS 7,470,000

A. Master Planning 200,000

Provides for the updating and further development of existing master plans for the field installations, including facility studies and site investigations. Documentation will define facility parameters within which subsequent engineering efforts will be based for future development. Provides for the documentation of existing plans where actions or deviations from previous plans have not been recorded for the various field installations.

Master plans at the various field installations are generally updated at cyclic 4-year intervals. Approximately one-fourth of the field installations are involved in any one fiscal year, keeping the level of effort relatively modest and constant. These plans provide for the orderly consideration of the allocation, proper arrangement, and efficient correlation of land areas and structures to serve the purpose of the various installations. Representative master planning activity candidates for FY 1982 are:

(1) Jet Propulsion Laboratory

A major update to incorporate current and proposed land/facility utilization plans, leased facilities, and flood plain maps.

(2) Kennedy Space Center

An update of the facilities inventory base and land/facility utilization plans to include new Shuttle and payload facilities.

(3) White Sands Test Facility

A minor update to incorporate current land/facility utilization, new Tracking and Data Relay Satellite facilities, and relationships to the Northrup Strip.

B. Sustaining Engineering Support 1,120,000

Provisions for facility studies and specific engineering support continue in importance as evidenced in recent years, and must be given high priority throughout FY 1982. These efforts are important due to the unpredictable cost situation which currently exists and may continue; cost trends in construction materials

and fuels; the continuing importance of energy conservation and efficiency; and the operation and maintenance cost for the physical plant. This includes provisions for maintaining a current engineering data base and updated construction specifications for utilization by the various field installations.

The following items are included in the FY 1982 requirements:

(1) Building Research Advisory Board Support

Covers annual support to the Federal Construction Council's (FCC) operations and provides for special studies that the Council will perform throughout FY 1982 to help advance the science and technology of Federal Government building and construction. The FCC is subordinate to the Building Research Advisory Board, National Academy of Sciences, and its activities are supported by several Federal Agencies including NASA.

(2) Utilities Services/Rates Analysis

Provides resources for the availability of continuous services in support of utilities procurement and utilities control systems. This includes, but is not limited to, technical assistance, surveillance, and recommendations with regard to utility rates, contract negotiations, systems operations, and utilities control systems. Because of continuing increases in energy costs, these services are an annual requirement and continue to be essential.

These resources enable the Agency to insure that fair and reasonable rates are charged under its major utility contracts. Essential and valuable technical assistance is provided to our field installations so that effective negotiations can be conducted with utility companies. Several major utility contracts per year require some technical assistance as utility contract rates are renewed throughout the Agency.

NASA's significant ongoing investment in utility control and management systems requires a high level of technical maintenance and support. The proper function and operation of the equipment are essential in order to realize the benefits. These resources provide the high technical capabilities needed to maintain the system and insure proper operation and use.

Use of these services is essential to the technical maintenance of NASA's utility control and management systems which require timely coordination and technical oversight to insure proper use and function of the Agency's investment in utility control and management systems.

These resources will provide for an updating of our system for forecasting utility costs and rates, so that better and more reliable utility budget requirements can be established. The accuracy and credibility of these forecasts impact the Agency's planning for other resources.

These and other similar utility system services are provided for by these resources in order to insure technical competence and properly manage this function.

(3) Facility Operation and Maintenance Analysis

Provides for continued engineering support for implementing improvements at NASA field installations relative to manpower utilization, work control systems, preventive maintenance, facilities management and reporting systems. Improvements will also involve techniques to identify where and how increases in productivity are possible by using earlier, reliable measurement methods. Included in this activity are field surveys to be conducted on a priority basis at selected NASA field installations to evaluate the effectiveness of the operations and maintenance management systems.

(4) Value Engineering Cost Validations and Analyses

Provides for engineering services to improve cost-effectiveness of facility projects by subjecting project design criteria, specifications and working drawings for specific material components and systems to a detailed independent review by engineering specialists in the particular area of involvement. *Also* provides services necessary to accurately predict and validate facility costs which will aid in resources planning for the various field installations.

(5) Facilities Utilization Analyses

Provides for the analyses of Agency-wide facilities utilization data covering: (1) office and other types of building space; (2) designated major technical facilities; and (3) special studies comparing the utilization of technical facilities which are similar in type or capability, such as wind tunnels. Such analyses provide for the review of data assembled in various formats, thereby permitting: (1) insights into and development of better methods of identifying underutilized facilities; (2) improved techniques of quantifying level of facilities use; and, (3) actions for improved facilities utilization. Work provides for review of each installation's inventory data base in support of the facilities utilization program. Surveys are necessary to validate the reported data in relation to a specific problem or need, and to assist in providing a credible foundation for plans to improve the utilization of facilities.

(6) Environmental Studies

Provides for the identification of potential environmental problems or the quick resolution of any related controversies at the NASA field installations. These conditions may be brought about by:

- New federal, state and local environmental regulations, emission standards and environmental management planning programs that must be considered at various installations;
- Changes resulting from new or expanded program activities, new facilities, or major site expansions at NASA installations; and,
- Changes that take place in the external environmental conditions at NASA installations.

Early identification of potential environmental problems and quick resolution of these and related controversies at the installations are important. Project managers and facility planners require up-to-date, accurate information to comply with legal and regulatory requirements.

C. Preliminary Engineering Reports and Related Special Engineering Support 2,300,000

(1) Preliminary Engineering Reports (PER's) ..... (1,700,000)

Preparation of PER's, investigations, and project studies related to proposed facility projects in the FY 1984 and FY 1985 Construction of Facilities programs are provided for by this estimate. These reports are required to permit the early and timely development of the most suitable project to meet the stated functional need. Reports provide basic data, cost estimates, and schedules relating to future budgetary proposals. This request provides for PER work associated with proposed construction except as provided for in other requirements (paragraph 2) for Shuttle Spacelab/Payload and certain energy conservation initiatives.

The estimated cost of PER support for FY 1984 construction projects is $950,000 which will permit updating of PERs for $20-25 million of construction, and the development of new PERs for an additional $35-40 million of projects.

An additional $750,000 has been included in this line for the completion of new PER's for approximately $35-40 million of construction projects which will be high priority candidates for inclusion in the FY 1985 Construction of Facilities program. The activity associated with FY 1985 will be confined to the most urgent and clear-cut priority candidates.

(2) Related Special Engineering Support ..... (600,000)

Investigations and project studies related to proposed facility projects to be included in the subsequent Construction of Facilities programs are provided for by this estimate. Such studies involve documentation and validation of "as built" conditions, survey/study of present condition of such items as roofing and cooling towers, utility plant condition and operational modes, analysis and support of environmental impact assessments and statements, and other like studies. These studies are required to allow for the timely development of projects to meet the stated functional needs and to provide basic data, cost estimates and schedules for related future budgetary proposals.

D. Final Design 3,850,000

The amount requested will provide for the preparation of designs, plans, drawings, and specifications necessary for the accomplishment of projects other than Space Shuttle, Spacelab, Payloads and certain energy conservation initiatives. Amounts required for those efforts are included under other requirements (paragraph 2). Projects involved are planned for inclusion in the FY 1983 and FY 1984 programs. The goal is to obtain better facilities on line earlier at a lower cost.

The request will provide for final design work associated with construction proposed for the FY 1983 Program, estimated to cost $45 to $55 million, and for $10 to $25 million of high potential projects proposed for the FY 1984 program. The amount included for FY 1983 candidates and for residual requirements of this nature which have accumulated from prior years' final design activities is $3,000,000. For FY 1984, $850,000 is included and the supporting rationale is much the same as that set out in the PER estimate.

2. OTHER REQUIREMENTS.. 3,530,000

Other facilities planning and design requirements are generated by programs which are large in size and of a complex nature. Those in this particular request are primarily associated with space programs which require a long planning cycle. Early and progressive design work is essential to ultimately ensure the best design, cost estimate and schedule. These programs require planning effort and associated design lead time well beyond that normally associated with general type facility projects. These requirements must be provided for beyond the regular and most recurrent facility planning and design needs.

A. Space Shuttle Facilities Planning and Design 1,900,000

This requirement is primarily for the preparation of the final design drawings, specifications and associated site investigations required for construction of future Space Shuttle facilities that have been

validated. These requirements are related to the Solid Rocket Boosters (SRB) processing at Kennedy Space Center and the External Tank (ET) manufacturing at Michoud Assembly Facility. Projects forecasted for FY 1983 include SRB storage, relocating workstands from the Vertical Assembly Building to a new location and expanding existing SRB washout facilities at Kennedy Space Center, and additional production related facilities to support the maximum ET production rate such as ET storage facilities, additional Thermal Protection System (TPS) application cells and associated supporting facilities.

B. Spacelab/Payload Facility Planning and Design 580,000

The requirement is for the preparation of Preliminary Engineering Reports (PER's), facility site investigations, design of facility projects, and studies to determine facility capabilities required to support the operational phase of the Space Transportation System pertaining to Spacelab/payloads. Included are facility requirements for the integration and checkout of Spacelab/payloads, upper stage vehicles, and housing and maintenance of associated flight and support equipment. Projects forecast for FY 1982 include a facility to increase hydrazine propellant loading capability, additional payload user support facilities, and possibly additional facilities for payload canister processing.

C. Energy Reduction Analysis and Support..... 1,050,000

Provides resources for the fourth phase of requirements for energy management and reduction analysis in response to the continuing effort to reduce energy consumption. Energy developments and considerations continue the need to improve the management of the Agency's energy resources. Some of the major considerations are: (1) the urgency to conserve energy as an essential element of good business and economic viability; (2) the continuing focus and emphasis on striving to achieve the goals of Executive Order No. 12003 and the National Energy Conservation Policy Act (NECPA); and,(3) the continuing emphasis resulting from the national energy situation to maintain a source and quantity of energy needed to accomplish the Agency's mission. These resources cover those special needs which are related to complex facility studies, analyses, and other preliminary activities leading to the better identification of cost and energy effective facility projects and improved energy management. These preliminary activities continue to be essential and vital to the total effort of effective energy consumption reduction, and must be undertaken on a priority basis if near-term and long-term energy use reduction goals and improved energy management are to be attained.

NASA continues to identify, study, and develop new energy conservation initiatives and improved energy management techniques. These result in sound and effective facility projects, improved facility operations, and better awareness. Energy conservation projects and operational changes improve efficiency and minimize the impact of rapidly rising energy costs. These planning resources have lead to appreciable energy savings and identified the most prudent and cost effective modifications to facilities. Potential savings are

significant. An eight to ten percent additional reduction in energy use from the FY 1973 base year is possible and can result in an estimated additional utility cost savings of between $9 - $11 million per year in terms of average FY 1982 energy costs. In order to realize these additional savings, it is essential to continue the timely identification of future facility investments. If this is not done now, additional utilities costs will accrue and other costs will continue to rise, requiring ever increasing budget support in the future.

(1) Provides for technical and engineering support, studies, and analyses to update energy criteria, plans and directives, design methodologies, operation and maintenance procedures, research testing procedures, facility energy impacts of new programs, and the evaluation of the energy management effectiveness. These resources will also provide for the completion of studies already underway and other residual efforts.

(2) Provides for technical services, studies, analyses, and planning for the use of alternate energy sources to substitute for the scarcer fossil fuels. As some forms of fossil fuel become scarcer and more costly to acquire, the substitution of waste products, solar, wind, biomass, coal, etc., becomes more essential and cost effective. The increased utilization of coal in an energy efficient and cleaner manner is also included in the effort. These alternate sources of energy require deliberate and careful planning and analysis if prudent and reasonable future investments are to be made.

TOTAL..... 11,000,000